

Lean, green and clean

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Shoemaking in common with many other manufacturing activities is all about transforming raw materials into components and then assembling those components in order to create a final product. Those familiar with the complex world of footwear manufacture will be well aware of the enormous variety of different materials—both natural and synthetic—that are used to make a shoe, their varied natures and characteristics, as well as the difficulty in utilising them all with the lowest possible level of waste.

Moreover, the shoemaking process is itself highly complicated and involves a

large number of operations. It also still requires a high degree of labour content and a vast array of different machines. These all need power to be operated, use different chemical substances to perform their tasks, create noise and generate pollution. While any of these aspects might in themselves have had little relevance in the past, in our present climate of environmental awareness, sustainability, and green consciousness, companies in all sectors are now under pressure to find proper strategies with which to address them.

If in the past companies were compelled to stick to environmental and safety regulations in order to sell their

products in specific markets and according to the laws that each country enforced, we can now detect a change in their mind-set stemming from a different perception on the part of consumers towards these issues. Regulations that used to be regarded as a cost burden that impacted on competitiveness compared to producers in other countries, less attentive to such environmental issues, are increasingly seen as a way to provide footwear with a 'green label' that more and more consumers seem to be prepared not only to accept but also to actively prefer.

In other words, whether something is green or not is becoming an important



selling point and a key factor in defining a product or brand. And this, in turn, necessitates a clear understanding and consideration of which product and process paradigms a company should seek to adopt in order to meet this important challenge. So, what exactly is meant by the three words: lean, green and clean?

LEAN

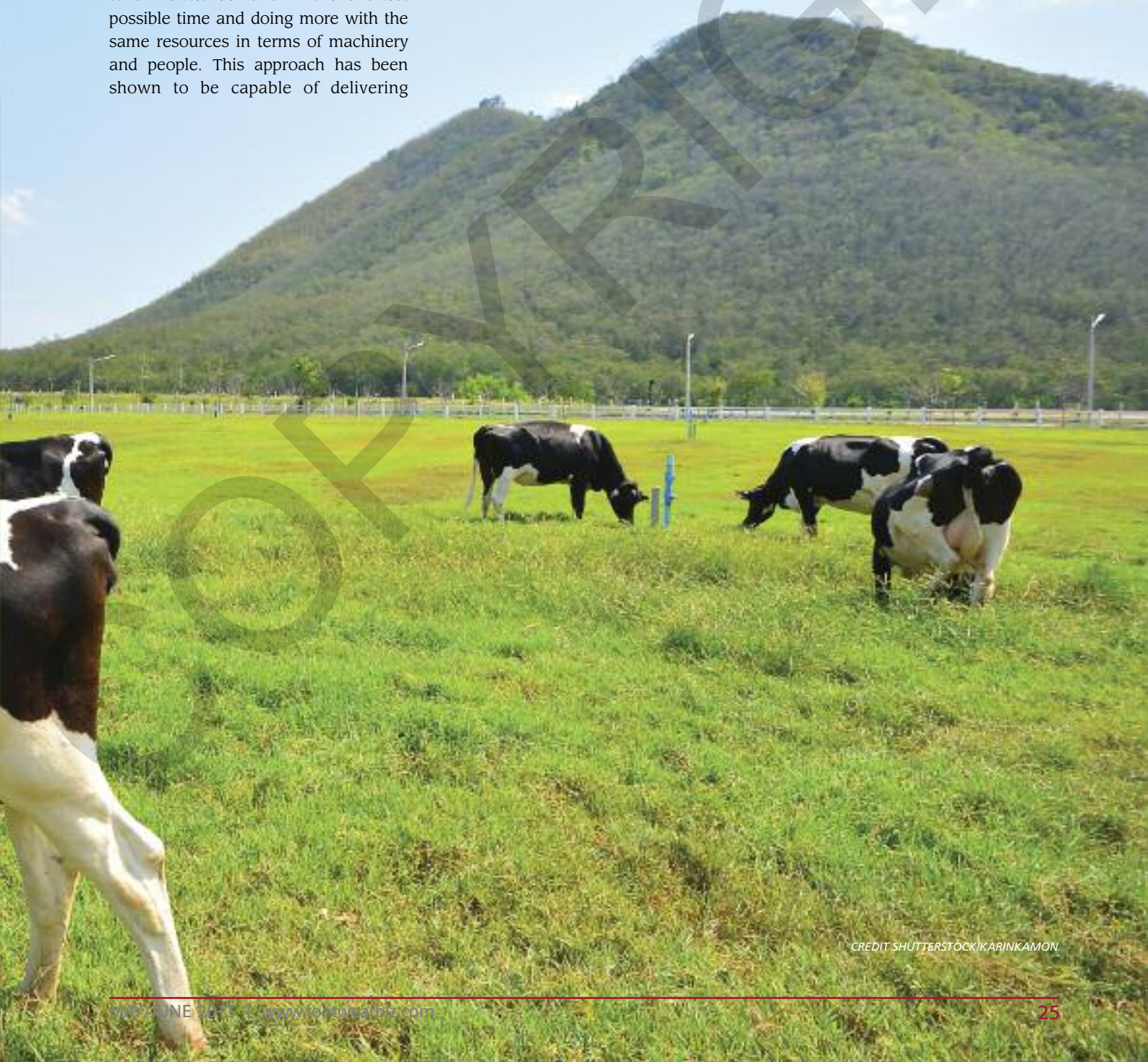
Lean has become a very popular manufacturing approach in many different industrial sectors and is now also gaining ground in shoemaking. Lean is about producing a business output (a product or a set of products that the market wants) as fast as possible, of being capable of responding to a market demand in the shortest possible time and doing more with the same resources in terms of machinery and people. This approach has been shown to be capable of delivering

improved efficiency and productivity. Indeed, in some instances, a 15% increase in output has been achieved with the same resources, accompanied by enhanced quality, better time delivery performance and, last but not least, improved morale and employee engagement.

It stems from the application of a set of management practices based on the so-called Toyota Production System. As with many other similar Japanese management systems, this has two goals: first eliminate waste and non-added value activities through continuous improvement and, second, practise respect for people.

Waste, as far as lean terminology is concerned, has a meaning directly

opposite to added value whose definition is in fact very enlightening. Any activity in a process is considered an 'added value activity' if customers are willing to pay for it, if it changes the end product to make it closer to one customers want and will pay for or, finally, if it is done right first time. These are very strong funding principles of the lean approach that must be set as clear targets in any reorganisation aimed at the introduction of lean manufacturing. Their application also requires leadership in a form lean defines as enabling and empowering people, helping them to grow, allowing them to take pride in their work and so helping both themselves and the business to continuously improve. Process



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Setting and conditioning machines from Barrera now use different components and heat sources to reduce energy consumption.

CREDIT: BARRERA SRL

reorganisation and leadership are therefore key factors.

But what are the economic benefits in lean manufacturing? These come primarily from the drastic reduction of work in progress (once again all the resources needed to fulfil customer orders) and in its costs though minimising the time between a customer order and its final delivery. The shortest production time in fact often costs the least which in turn means less cash is needed to sustain production. When we come to implementing the lean thinking in manufacturing, it is useful to look at it as a search for the 'hidden waste' that is typically present in traditional manufacturing scenarios. This can involve waiting for a new design to be ready, a machine to be free, a tool to be available, parts and materials to be delivered or simply for previous jobs to be finished. Time wasted is money wasted and must be avoided at all levels.

Defects and rejects are another critical source of waste because they cost money, burn resources and create delays. Inventory, if badly planned and administered, can be another relevant waste particularly in relation to the inefficient use of materials in production. Only what is needed must be used, where it is needed and at the right point in time. Overproduction caused by inadequate planning methods or weak sales forecasting is another typical hidden waste as, also, are over or extra processing involving excessive movements in the manufacturing process, excessive machine set-up or down-time delays and production line bottlenecks.

Less obvious but no less relevant sources of waste are motion and transportation. The first issue relates to all unnecessary personnel movements to fetch specific tools, move from one station to another and visit other areas of the factory to retrieve documents or other kinds of paperwork. While it might not be readily apparent, taken as a whole, these can account for a big waste of time and resources.

Something similar is also true with transportation in terms of unnecessary movements or handling of parts, handling equipment moving with no parts at all, raw material batch sizes not matching actual production batches or simply materials stored a long way from where they are needed in production. All these aspects may lead to a profound revision of the factory layout and a reorganisation of its work-flows.

Being aware of these potential sources of waste, identifying them and devising solutions is the correct path for the implementation of the lean manufacturing paradigm.

GREEN

The second of the three terms, green, has several meanings and can be associated with several concepts, all of them related in general to the environment. There are two immediate implications we can consider that are closely related to the concept of sustainability. The first is the efficient use of available resources (something we could also consider as a natural extension of the previous lean philosophy) and the second is environmental respect and protection that we will discuss in the final section about 'cleanness' in manufacturing. We will focus here on the resource issue where a process can be called green if it makes minimum demands on resources and uses them to their best advantage. The most obvious resource a manufacturing process can use is energy, the electrical power needed to operate the various machines that are present on the production line.

A key area concerns weak crosslinking or networking of machines in a shoe factory. In addition, the complexity of the assembled components also plays an important role in the rather poor energy efficiency level in the footwear industry in general. Furthermore, many shoemaking operations have a substantial manual content and this brings the human factor into play. Each person is different, so their manner of working will be different. This, however, is something that can be controlled, improved and optimised. Given the complexity of the shoemaking process, the different types of machines and their various technologies, a thorough understanding of all that is involved is indispensable if one is seeking to make changes. In a shoe factory there are big power consumers that are a factor in high-energy costs. Some of these can be improved to minimise the cost of production which, in turn, would have a positive effect on buyers.

A crucial role in energy efficiency as many studies in the auto and textile industries have shown is played by the behaviour of the employees themselves. Personnel management can be a key influence in increasing energy efficiency in a factory by making employees more sensitive in regard to energy efficiency and more aware of wasting power. An example from the auto industry shows how important the conscious behaviour of employees can be in achieving the green star.

A Ford plant in the Netherlands introduced a programme to increase energy efficiency. Many of the offices in this plant had central heating systems and the simple fact of employees being told to report to the central heating control unit that the temperature in their offices was too high instead of opening the windows, brought a decrease in heating costs of about 5%. This is a good example of how a simple remedy can have a large scale positive effect.

Another issue is the identification of hot spots in the shoe production process. Due to lack of information on how much power individual steps really consume, detailed power consumption surveys are needed. Concepts such as 'Internet of things' or 'Smart Factory' (machines that talk to each other, communicating their state and conditions like computers in the world wide web and so make the whole factory smarter in terms of managing process data), might be considered when

applying down-stream energy efficiency increasing strategies. The new, emerging concept of RCM (resource conscious machines) could however represent the right solution.

This concept is a mixture of energy efficiency, automation (applied technical development), raw materials scarcity, product design and human resources specialisation. The concept has its roots in information technology where the development of resource conscious processors is still one of the highest priorities. In big lines, an RCM machine can be described as one which consumes a minimum of energy in order to fulfil its function with a minimum usage of materials and by a minimum input of additional human resources capital. Going a stage further, the same can be said about a resource conscious process, RCP.

An RCM-design is strongly interconnected with applied automation and sensory and self-learning software. In the special case of the footwear industry, product design is very important in developing a RCM because a material(s) conscious machine can only be so when the product is designed according to the concept of minimum usage of resources. In the cutting and lasting departments of any footwear factory there is huge potential in applying the concept of resource conscious machines and processes. The increase in energy efficiency of automated operations can be a very important factor in decreasing production costs. Investment in research and development of RCM and RCP for the footwear industry should therefore be a priority for shoe producers interested in long-term development.

Shoe machinery suppliers also need to be involved and some are in fact already developing a high level of awareness on this topic. A good example is the new Main Group E266 Evaluation EVA injection moulding machine that incorporates a technology very similar to the one that we are getting to know in our cars as 'start and stop', where all main power sources are cut off when not needed and then reactivated on demand. A further one is the new generation of thermal setting and conditioning units produced by Barrera—also from Italy—that use different components and heat sources to dramatically reduce the energy

consumption of these otherwise power hungry devices.

A second useful reference framework along the green path is the Energy Management for Increasing Energy Efficiency in the Footwear Industry concept, founded on basic rules of management theory and other energy management guide lines. The first phase in this management process would be to collect technical information starting with production layouts, electrical properties of machines on production lines and power consumption per shift, day, week, month and so forth, with close attention paid to stand-by modes on the lines. This data collection phase should be carried out in as many factories as possible in order to have an overview on how, where, when and why electrical power is used.

Having this information, a strategy can then be created to localise weak points and big power consumers in an individual factory by measuring or using the available data from all those in the survey. The energy efficiency potential can be analysed for each department, division, machine and any other entity. The potential for both technical and cost-effective improvements can be identified and global and local solutions developed. These solutions will be concentrated on process integration and increasing machine networking.

Examples of possible actions are improving production layout, increasing machine networking (especially the lasting department), replacing old motors, investing in new energy efficient

machines, modernising building insulation and heating/cooling systems and employee training on energy efficiency. A special part of the concept would in fact be personal management. In order to increase the awareness of employees on energy efficiency, the factory must have internal guidelines, internal procedures and even special clauses in work contracts. Concept implementation, as well as expansion, standardisation and process, plus operations automation would all help to drive forward the goal of a lean, green and clean production that led in turn to a reduction in production costs.

CLEAN

Footwear manufacture traditionally has used natural products such as leather, wood, etc. In contrast, modern shoe design and production processes consume a huge amount of non-renewable raw materials, so alternative material concepts should be considered. A fully recyclable production approach would give the shoe industry a significant push towards sustainability and 'green and clean' production. Even without venturing that far ahead with this ultimate dream, however, there certainly remains a potential for improvements to make shoemaking a cleaner process in several areas.

Upper and soling leathers tanned with non-toxic substances for maximum wearer safety are designed to be non-pollutant to the environment to which they will probably return. Synthetic materials for both uppers and outsoles



Main Group's E266 Evaluation EVA moulder is an example of the RCM concept.

CREDIT: MAIN GROUP TECHNOLOGIES

produced in the same way and for the self-same reasons. The elimination of dangerous solvents and other noxious or toxic substances used in the various steps of manufacturing; water-based cements have progressed impressively but their usage is not yet as widespread as it might be. And, eventually, clear and applicable EOL (end of life) strategies that while not necessarily resulting in truly recyclable shoes, could at least lead to a reliable assessment of their residual impact on the environment.

Some machines are already complying with this clean part of the paradigm. A good example is lasting machines in which the traditional thermoplastic cement is replaced by a water-based fluid system that is more easily applied and also contributes to a reduction in the energy consumption of the machine as in the case of those produced by Cerim in Italy.

If factories can become leaner, their processes greener and the shoes they produce generally cleaner, the footwear industry will undoubtedly take an impressive step forward. It will make important returns not only in terms of better efficiency and higher margins for the companies involved but, also, gain a competitive advantage among a new generation of consumers more interested in and responsive to these arguments. Finally, our world will also be a better place to live in and that is surely a target worth supporting and fighting for. 🍏

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The Cerim K78TP forepart laster uses water-based adhesive instead of hot-melt. CREDIT: CERIM SRL

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but rather a value-added component
to the shoe design."*
- Lisa Howlett, President

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