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What's the future for manufacturing?

Footwear manufacture has changed and developed enormously over the years, moving from what was essentially a craft occupation to mass manufacture during the 19th Century, though still employing traditional constructions albeit in a mechanised form. The 20th Century saw new constructions and materials appear, especially in regard to soling, with the introduction of the cemented, direct vulcanised and injection moulding processes using rubber- or polymer-based materials. The shoe upper, nevertheless, still required cutting and stitching, although advanced technology in the form of computer design and control helped to reduce the high operator skill levels previously called for.

The other and, perhaps most revolutionary change, however, involved a fundamental shift in where footwear

was produced. In the space of only some 25 years, footwear manufacture on a large scale that had previously been the preserve of advanced Western industrial nations, moved to Asia where labour costs were a fraction of those in the West. This was driven by sports shoe brands typified by Nike who were marketers as opposed to manufacturers and, having no ties to any existing manufacturing base, enjoyed a degree of flexibility that enabled them to have their shoes produced wherever in the world was cheapest.

Margins on the other hand were higher and soon many other categories of footwear followed suit. It was not without its problems however. Quality management initially proved difficult, extended manufacturing lead times meant large inventories and stock write downs on slow moving lines that all ate into those margins. By the turn of the 21st Century, another problem arose.

China, by now the great global hub of footwear production, began to experience an escalation in labour costs and an increasing reluctance for people to seek work in shoe factories when jobs were available in more glamorous industries such as electronics where wages were higher.

INNOVATIONS IN TECHNOLOGY

The past few years have also seen some exciting new technologies appear which have the ability to totally revolutionise footwear manufacture in terms of both how and, indeed, where it can be produced. 3D printing is one that is increasingly being seen as a solution to many industrial processing problems and the key to future manufacturing in general. Reebok, for example, is developing the Liquid Factory where software and robotics draw three dimensional shoes and then create the

final article by 3D printing using a proprietary liquid material from BASF. The company says this technique creates totally unique footwear quickly and without using traditional moulds.

Adidas unveiled its Futurecraft MFG (Made for Germany) sneaker last year, the first shoe produced at its Speedfactory production facility in Ansbach. This is almost entirely operated by robots and large-scale production is planned to begin this year, followed by a second unit in Atlanta, US. The Futurecraft MFG uses adidas Boost technology for increased energy return when running and was designed using the company's advanced Aramis motion capture technology. This makes it possible to examine exactly how the foot functions when running and apply that data to produce a shoe that has the optimum performance possible.

What do these two projects have in common? They are both very 'high tech' and are both taking place on home soil. One factor behind this growing trend to on-shoring is that some of the low cost producers are no longer as low cost as they once were, especially China. The other and, possibly more significant, factor is that the advanced technology employed is making it an increasingly economic proposition to bring manufacture back to Western countries. Lead times are extremely short, the supply chain is effectively eliminated and inventories are minimised. Although the capital investment is high, this is offset by the cost savings that can be made from the ultra efficiency of the whole operation; humans are prone to make mistakes whereas correctly programmed robots do not.

LOCAL-FOR-LOCAL

Under Armour CEO Kevin Plank is taking his sports shoe brand in a similar direction with the 'Lighthouse' in Baltimore. This is a 35,000-square-foot building filled with 3D printers and other high tech systems where new ideas can be brought to fruition in a fraction of the time and cost it would normally take. Plank says the Lighthouse is the 'tip of the spear' of innovation in an industry that needs to catch up and believes Under Armour can reduce manufacturing costs and save time and money, while ensuring higher quality by reducing chances for error by having fewer component parts.



Under Armour says its Lighthouse project is the 'tip of the spear' of innovation for the footwear industry. CREDIT: UNDER ARMOUR

He wants to create tens of thousands of new manufacturing jobs in the United States but says that new innovations in manufacturing and systems are needed for it to be a fully competitive reality. He also wants to take this idea a step further with his local-for-local vision whereby the Lighthouse will design products that will then be made in local markets around the world. He believes that, as in the US, every market around the world would prefer to have its product made locally if possible rather than imported with all that implies. By having innovative manufacturing hubs such as this operating in each region, local manufacturing could become a practical possibility for most countries.

DIGITISATION

In his article on Industry 4.0 elsewhere in this issue of *World Footwear*, Sergio Dulio outlines the tremendous technological gains and benefits that will accrue from digitisation as it is increasingly applied to manufacturing systems and processes. He also discusses the disruption it can cause as in the case of Uber and the impact it has had on the traditional taxi business model. By owning no cars and employing no drivers, it is able to offer a faster service at a very competitive price as it is using other peoples' assets rather than its own as in a conventional business model. It has succeeded by harnessing the potential of the sharing economy and the power of the digital transformation

of processes and business.

Unlike the complex footwear industry, the taxi industry is relatively simple and at its lowest common denominator requires just a driver, a car and the fuel to power it. The smallest shoe factory, on the other hand, is merely a link in a long supply chain from raw material to finished product and consumer. What digitisation can do for the footwear industry is to simplify the way it makes shoes such that they can be produced almost anywhere in the world with a minimal labour force trained in computer rather than shoemaking skills. No tradition of shoemaking is called for and the necessary investment can come from any quarter. This fits perfectly into the Under Armour format.

This could of course also be said to be disruptive in the sense that it is a radically new way of looking at things and this is essentially what Kevin Plank is saying the industry needs. He does not have a shoemaking background and therefore no preconceptions as to how shoes should be made. In 1996, he was a talented college athlete frustrated by constantly sweaty T-shirts. Deciding to do something about it, he set out to find fabrics that would breathe and dissipate body heat and then turned them into a revolutionary T-shirt that formed the basis for the Under Armour brand. Such shirts are easier to make than shoes you may say but, with the increasing use of Industry 4.0 technology, shoemaking will become increasingly simplified too.



The relatively simple format of Athleisure type footwear makes it ideal for advanced production technologies. CREDIT: MESSE DÜSSELDORF, CONSTANZE TILLMANN

ANTI-GLOBALISATION

There is also the protectionist stance of many politicians to consider, resulting one suspects to an increasingly anti-globalisation attitude that is being taken by many voters in Western countries who feel that rather than benefit from it, they have been exploited by it in terms of jobs lost to the expanding economies of Asia. President-elect Trump has said he wants to see jobs brought back on shore and, as the US is still the world's largest economy with huge consumer spending power, footwear brands operating there will have to seriously examine how they would cope with a scenario that might include expensive import duties on foreign sourced goods.

The United States is not alone and other countries where voters want to 'get their jobs back' may well choose to follow, particularly in Western Europe. Italy's Referendum in December would seem to support this. Many voters may not however realise the full implications. Rather than create more jobs, a reduction in free trade has the potential to slow the global economy and increase prices. Globalisation has in fact delivered a steady incremental increase in consumer buying power in recent years; this positive trend could be halted or even reversed, living standards might fall and current low interest rates rise, leaving consumers with less spending power.

Another major change in where footwear is produced is therefore a

distinct possibility. Whether it will follow the local-for-local pattern suggested by Kevin Plank or some other perhaps similar format only time will tell. What is certain, however, is that leading brands such as addidas and Reebok have seen the signs and are exploring high tech solutions that would enable them simplify and transfer production by using new constructions and materials, extensive 3D printing and increased use of Human Robotic Cooperation. Clearly this would not affect high fashion or top quality traditional footwear but, as so many people now wear athleisure type products, the impact would still be enormous.

CRYSTAL BALL GAZING

A truly futuristic scenario for the way footwear is produced could possibly be one where instead of there being shoe factories, there are drop-in centres along the lines of Internet Cafes where you could scan your feet for size and shape, choose a design online, enter your data and download a software program which is transferred to a 3D printer. You then go about your business while the printer produces a pair of custom made shoes. You pay electronically and walk out in them leaving the old ones behind to be totally recycled.

A far fetched notion? Certainly for the foreseeable future because a radical scenario would create total upheaval, with most parts of the industry as we

know it becoming redundant with all the repercussions that would involve. For instance, what would we do with all the millions of hides that would no longer be required for the production of leather? However, from a purely technical viewpoint we only need two things to make it all possible.

The first is the right polymers to produce a 3D printed shoe that behaves like a conventional one in terms of physical performance. Chemical companies such as BASF and DOW Chemical have huge financial resources and are investing heavily in this field. As a result, new 3D printing materials are advancing at a frightening speed and, as with all new technologies, the costs will fall dramatically as the process is further developed. The second is the ability to combine more than one type of polymer in the shoe.

There are in fact already 3D printers, such as the Connex family from Stratsys, that can print materials with different degrees of rigidity at the same time and in the same build. In theory, this could make it possible to print all the rigid and soft parts of a shoe in one go, without any need of assembling them later. Although nothing commercial is yet available, it cannot be long before it is. In the meantime, other companies such as Feetz, are choosing a different route and are printing rigid and soft materials separately and then assembling the various parts together in a manner similar to the traditional cemented process. We are still at the beginning of the 3D printing revolution and there is much yet to come.

As of now when we are surrounded by so many global uncertainties, it is very difficult to predict what might happen in the next few years, let alone longer term. One thing we can be sure of, however, is that the footwear industry will continue to embrace new technologies as it has always done and use them to provide consumers with ever better quality products. Where they will be made is still open to question as these new technologies will continue to simplify the shoemaking process and create a more level playing field in terms of costs such that, in the future, they could have the potential to be made anywhere and everywhere. 