The impact of robotics and automation on logistics

An insight into how the logistics sector could be impacted by advances in manufacturing technology

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One of the most talked about subjects at the WEF meeting at Davos 2014, was the impact which advances in manufacturing technology will have on production. In the past two years much has been written about 3D printing but less attention has been paid to developments in robotics which could have an equally material effect on industrial practices. This will have undoubted implications for global supply chains.

Of course automating production lines is nothing new. Many industrial relations battles have been fought over efforts to introduce robots to the production process, especially in the automotive sector. However what is happening now has the potential to go much further.

The Supply Chain implications of automation

Logistics companies must take note of these developments as they will lead to direct and indirect transformative pressures on the industry.

Firstly, the production strategies of their clients will change dramatically. By adopting the latest robot technology for such basic and repetitive tasks such as ‘pick and place’ there is the opportunity for employers in the West to rapidly reduce labour costs. Robots are especially good at undertaking functions where precision or consistency is required.

This of course would rebalance manufacturers’ labour costs, and reduce the competitiveness of remote markets. This trend would be reinforced by manufacturers increased awareness of global supply chain risks and other near-sourcing pressures. This could lead to manufacturers preferring to establish new facilities in or near to the major consumer markets in North America or Europe.

Intuitively, the sectors which are most likely to lose out from these changing patterns of upstream and downstream distribution will be the freight forwarders, shipping lines and air cargo carriers, focused as they are on global flows of goods. However what may happen instead is that economic growth is stimulated by the adoption of these new technologies. This will have an ameliorative impact on the size of the overall market, although the fastest growing segment will become domestic/regional distribution.

Direct impact of robotics on logistics

Secondly, there is the direct impact which advances in new technologies could have upon the transport and warehousing industry. The sector of course is very labour intensive both in terms of drivers and warehouse staff. In twenty years however this situation may well have changed dramatically. Google is already testing technology that will result in driverless cars, and it seems reasonable that, once
regulatory and labour organisation barriers are overcome, we will see a growing proportion of driverless trucks on the roads. This would have obvious benefits in terms of costs, but would also consign tachographs and hours of service to history, thus improving supply chain efficiencies.

In Japan such tests are already underway, led by the New Energy and Technology Development Organisation (NEDO) which has successfully trialled convoys of driverless trucks using sensors to identify their position on the road and potential obstacles. The trucks are able to brake with a reaction time of just 20 milliseconds and hence can take advantage of the slipstream of the vehicle in front – travelling in intervals of just four metres. NEDO believes this will reduce fuel costs by 15% - but of course by removing the driver costs there will be far greater savings.

Caterpillar already uses six fully automated and programmed mining trucks at a facility in Australia. They can run 24 hours a day, which would normally require a team of 4 drivers. They are monitored from a remote control centre although they have the ability to make decisions on whether to stop, go round or over obstacles themselves.

Although there is a long way to go before we see driverless trucks on shared roads, ironically it may be safety which becomes the main argument for their adoption. Governments are keen to reduce the numbers of people killed or injured in bus and truck accidents, and a large number of these incidents are caused by preventable driver-error. For example, a driverless vehicle will not be distracted by an incoming cell phone call and there would never be a blind spot for cyclists.

Once the truck arrives at the distribution centre it would seem entirely possible for the unloading and put away process to be entirely automated. Already in the US, Amazon is using robots in some of its distribution centres; in 2012 it paid $775m for robotics company Kiva Systems. Its robots bring product shelves to a human picker, rather than the human picker walking the aisles to identify product. According to the company this increases productivity by 3 or 4 times.

**The ethical perspective**

There are obvious social concerns arising from these advances in technology. Some believe that developments could result in a structural change in employment, similar to that seen in the industrial revolution. The steam engine, and subsequently tractors, decimated the numbers of agricultural workers required to work on the land. However at the same time as this, new jobs were created in factories which eventually led to the higher standards of living seen in the Western world today. Robotics could result,
many hope, in a similar pattern of change and it has been suggested that a new wave of employment would be created by the production, selling and maintaining of robots.

It has been estimated in one study\(^1\) that 2-3 million jobs could be created in sectors which are presently uncompetitive in world terms – in other words, where they are unable to compete against remote low cost labour markets. This would mostly apply to the electronics and automotive industries.

However researchers are very well aware of the sensitivity of the issue, and tentatively talk of integrating robots into teams of human workers, as a sort of collaboration. Google has created its own ethical committee to review the impact of its technology. Robotics companies themselves have started a ‘robots=jobs’ campaign arguing that those economies which have adopted this technology, such as Germany and Japan, have actually created more jobs than have been lost.

However the longer term implications are clear. There is no doubt that improving efficiencies will create value, stimulating economic output and leading to a demand for higher value adding jobs. The trick for politicians will be to transfer large manual labour forces (such as those in the logistics industry) to these higher value jobs, otherwise they risk creating an under class of unskilled and unemployable workers. This is a question policy makers will have to address carefully. A world without drivers or warehouse staff? This may be some way off, but certainly not out of the question.

**How quickly is 3D Printing developing?**

The development of 3D printing technology (additive manufacturing) is also continuing at a rapid pace and serious investment is now being made by global manufacturers into this technology. This is illustrated by the growing number of articles and features in the media focused on this topic. Many of the inferences and conclusions we made in our earlier paper regarding the impact of 3D printing on the Logistics industry remain relevant.

In one example, it was announced late in 2013 that researchers at Cornell University had managed to fabricate a working loudspeaker assembly using 3D printing alone. Apart from its plastic housing, the speaker includes a fully functional conductive coil and magnet spun from two specially designed desktop customizable printers. The coil is created from a silver ink extrusion, while the magnet is spawned from a high viscosity blend of strontium ferrite. It was then used to playback recordings to confirm its functionality.

\(^1\) “Positive Impact of Industrial Robots on Employment” Metra Martech, UK, November 2011
Printing items using multiple materials is not new, but to do so using relatively inexpensive desktop printers is an interesting example of how the technology is being pushed forward by the research community.

In the industrial sector, last month (January 2014), the Siemens Power Generation division was due to begin manufacturing spare parts for their gas turbines using 3D printing. These are heavy-duty industrial parts and it is hoped the process will reduce repair time from over 40 weeks to with 4 weeks. The parts will apparently be used within the turbine burner assemblies with the massive reduction in repair time resulting in significant cost savings.

General Electric (GE) has begun to detail the extensive use it will make of 3D printed parts within its commercial jet engines. They are planning to manufacture over 85,000 fuel nozzles for its LEAP engine orders entering production in late 2015. They are significantly increasing their investment in industrial printers to increase capacity to meet this demand.

The primary attraction is that the 3D printed parts are lighter, much stronger than conventional metal parts and can withstand the much higher temperatures (2400 degrees F) necessary. GE has been purchasing 3D printing manufacturers to accelerate this process and develop new generations of printers.

It seems that the other major aerospace manufacturers are following suit with Rolls Royce, Lockheed and Boeing introducing 3D printed parts into their manufacturing processes.

Some segments of the aerospace industry have discovered that by using 3D printing to print complete assemblies in one piece (e.g. Reconnaissance drones), they get a dramatic reduction in weight and tremendous increase in strength and durability. These developments will only help to increase understanding of the advantages to using 3D printing.

United Parcel Service (UPS) also announced last summer that it would install commercial grade 3D printers into all of the UPS stores across the US for use by businesses. This is undoubtedly as much a strategy for them to understand how this technology could change the manufacturing landscape and related logistics demands. It also gives them the opportunity to design new service offerings based on these observations. UPS already has a significant service parts operation, which we suspect will be the sector most likely to be impacted by the general adoption of 3D printing.
Despite these developments, industry is continuing to examine the extent to which 3D printing may impact global supply chains. The existing economies of scale in many sectors are unlikely to be threatened by additive manufacturing in the immediate future. The cost of the metal powers and plastic substrates used in existing machines is still many times more expensive than the same compounds presently used in conventional high volume production lines. But the raw material cost will probably come down and it is not the only significant cost factor in many supply chains.

No doubt the media hype will fade over time, but we expect to see more developments as this technology enters the mainstream and existing manufacturers as well as innovative start-ups challenge the conventional business models.

About the Authors:

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John started his working life as an operations manager in a freight forwarding and road haulage company based in the UK. Prior to establishing Transport Intelligence, he worked as an analyst in consultancies specialising in international trade, transport and logistics. He also spent a number of years as European marketing manager for UPS Supply Chain Solutions working at locations across Europe including France, Netherlands and Germany.

He holds an MSc in Transport Planning and Management from University of Westminster and is an Associate of King’s College London. He is a Fellow of the UK Chartered Institute of Logistics and Transport and a Member of the Logistics Global Advisory Council of the World Economic Forum. John has travelled widely, undertaking research and speaking at conferences in countries including China, Hong Kong, India, Japan as well as in the Middle East, USA and extensively throughout Europe. He is regularly quoted in the international and trade media as well as on radio and television.

Ken Lyon, Managing Director, Virtual Partners

Ken is Managing Director of Virtual Partners, a private UK-based organisation, providing solutions and advice related to global supply chain information services. He has over 30 years of experience in the transportation industry. Ken specialises in the use of advanced information systems to manage the operations of 3PL (Third Party Logistics), 4PL and Lead Logistics Providers and their trading partner networks.

Over the past few years Ken has helped to establish and develop start-ups concerned with supply chain visibility, analytics and on-line container shipping services. Before that, he spent 10 years as a Director and VP of information services at UPS, also helping to establish its Logistics and supply chain services Group.

Lyon also advises clients in the areas of supply chain risk, and potential effects of global terrorism on supply chain operations. He has also developed advanced information solutions for various government agencies.
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