

When there's Naught in the Juggernaut: Autonomous Trucking Beckons

Abstract

Freight trucking is integral to logistics, and often the most expensive part of a supply chain. With the concept of autonomous trucking becoming a reality, driverless trucks are set to take on the highways. Driven by the Digital Five Forces, companies are already deploying fully unmanned vehicles to improve and transform their business operations. These pioneering developments will drastically alter logistics, reducing timings and costs. Supply chains have to be aligned and prepared for the changes that are on the way.

This paper analyses how driverless trucking enables advantages such as seamless logistics, faster delivery, increased fuel efficiency, reduced labour costs, increased driver and pedestrian safety, and reduced environment impact. It also highlights the hurdles to embracing such autonomous driving technology as is the case with adopting any new technology.

Driverless Trucks are on Their Way

Freight trucking is integral to logistics. According to the Bureau of Transportation Statistics, in 2016, trucks carried 65.5% of all freight in the US,¹ and volumes of freight transported by trucks is expected to triple globally by 2050.² The efficiency of trucking, which is often the most expensive part of logistics, has an overwhelming influence on the success of a business' supply chain function.

The concept of autonomous trucking, that is trucks that operate with minimal human input, is inevitable. To some degree, it has already arrived in the logistics industry. In the US, goods such as refrigerators and voluminous cases of alcohol are being transported via autonomous trucking today.³

The key issues for the near-term adoption of autonomous trucking revolve around the speed at which and the extent to which automation will be implemented. Currently developments are proceeding in two tranches. Firstly, there is a move toward platooning powered by Internet of Things (IoT) technology. This involves a digitally tethered convoy of trucks collaborating to move as a unit at the optimal parameters to save fuel. There is also ongoing development of fully unmanned, autonomous vehicles.

Driverless Trucking will Enable Seamless Logistics

Driverless trucking promises a future free from accidents or human error, with increased tonnage hauled around the clock and engines put to economical use. To make this a reality, a number of companies are drawing upon the Digital Five Forces – cloud computing, mobility and pervasive computing, Big Data analytics, social media and artificial intelligence (AI). For example, GreenRoad, a fleet performance management solutions firm, is mining Big Data and using advanced analytics to assist drivers and organizations to optimize their trucking.⁴ Peloton is pioneering the concept of truck platooning with technology that enables groups of trucks to drive at close following distances while improving safety and fuel efficiency.⁵ Otto (now under Uber ATG) provides driverless add-on kits to convert existing trucks into driverless ones at a reasonable price.⁶ There has been a spate of collaboration between startups such as Peloton, backed by Intel, Denso, Castrol, and

In the US, truck drivers are currently limited to driving for 70 hours per week, roughly 3,000 miles, meaning that the average truck spends only 40% of its time carrying goods.

Volvo, and established logistics giants. Other exciting startups such as SmartDrive and Zonar Systems have raised considerable funding from diverse backers including universities, venture capital, and trucking manufacturers like Daimler.⁷

The automation of trucks will drive considerable savings due to reduced manpower costs and the ability to drive for longer. Combined with these limits is the fact that labour constitutes approximately 75% of the costs of shipping a full truckload of goods across the US.⁸ It is clear, then, that autonomous trucking can increase the volume of goods moved while simultaneously reducing costs.

While such end-to-end autonomous trucking is still some way off, the efficiencies to be gained from platooning technology will be realized imminently. Fundamentally powered by the IoT, trucks form a convoy using vehicle-to-vehicle and vehicle-to-infrastructure connectivity. By maintaining virtual contact through a network operations center using cloud computing, sensors placed on the trucks actively gauge other users, driving hazards, and each other. Remote control is possible through wireless communication or, in areas of no connectivity, active braking sensors can ensure safety.

When orchestrated into a platoon, the fuel savings that can be gained are immense due to the streamlined aerodynamic profile of a convoy of trucks versus a lone vehicle. Able to tailgate at a distance of only 10 feet, research from MIT shows that reduced drag will create fuel savings of upto 20% for trucks in the middle of a convoy. It is estimated that a five-truck convoy could save 17% on fuel compared to single trucks.⁹ Drawing on inter-vehicle connectivity, it will be possible to orchestrate trucks to leave as scheduled cadres or they will be able to platoon on-the-fly.¹⁰

Though human-populated highways bring added complexity, fully autonomous trucks are already driving savings in controlled environments such as mining. At Rio Tinto's Pilbara mines in Australia, automated fleets have outperformed manned fleets by 14% since 2008, while also reducing load and hauling operating costs by 13%.¹¹ Such vehicles are being trialled on public roads. In 2015, Daimler's autonomous Freightliner Inspiration truck was granted a license for road use

in the US.¹² Likewise, in 2016 six convoys of semi-automated trucks converged on Rotterdam after cross-border journeys in Europe.¹³ Most recently, Tesla's driverless truck Semi, projecting fuel savings of over USD 200,000, is likely to reach the road by 2020.¹⁴

Supply Chains will be Reinvented by Driverless Trucks

Supply chains must work around the constraints of logistics. Thus, the scope for autonomous vehicles to herald a transformative evolution in supply chain management and structure is significant. Autonomous trucking promises to do more than simply speed up delivery, increase fuel efficiency, and reduce labour costs.

With trucks travelling greater distances and around the clock, supply chain nodes and distribution centers can be consolidated at locations nearer to highways. Through digitization-enabled sensors, vehicle controls, and IoT technology, the concept of 'Just-in-Time' supply chain can be extended across a logistics network. Warehouse infrastructure, inbound and outbound logistics, and various fulfilment aspects will all be reformed around driverless trucks and other autonomous vehicles, including aerial vehicles.

A common asset base of driverless trucks can be managed by a warehouse management system (WMS) tuned to load optimum shipments according to truck capacity and space layout. A transportation management system (TMS) can calibrate capacity, speed, and arrival times to plan receipts and deliveries using technologies such as EPC, RFID, and barcodes. The digital connection between vehicles will enable greater oversight and planning of order fulfilments and returns. Cross-docking, when trucks are parked end-to-end and connected using conveyors, is an example of a practice that can be enhanced by automation.

Advantages of driverless trucks such as higher rate of on-time-in-full deliveries, smart inventory controls, movement consolidation and higher asset utilization, when incorporated into the supply chain function, have the power to drive substantial savings.

Autonomous Trucking will Save More Than Just Money

In 2012, there were 330 large truck crashes in the US, around 90% of which were caused by human error.¹⁵ Features of autonomous trucks such as adaptive cruise control and forward collision warning systems will be a boon to the safety of other road users, preventing injuries due to driver error. Research suggests that, with supportive governance policies and protocols, the adoption of driverless trucks could lead to a 30% reduction (from the year 2000) in the number of trucks involved in crashes by 2020, and a 90% reduction by 2040.¹⁶ Figure 1 depicts such scope for massive reduction in expected crashes by bringing in driverless trucks.

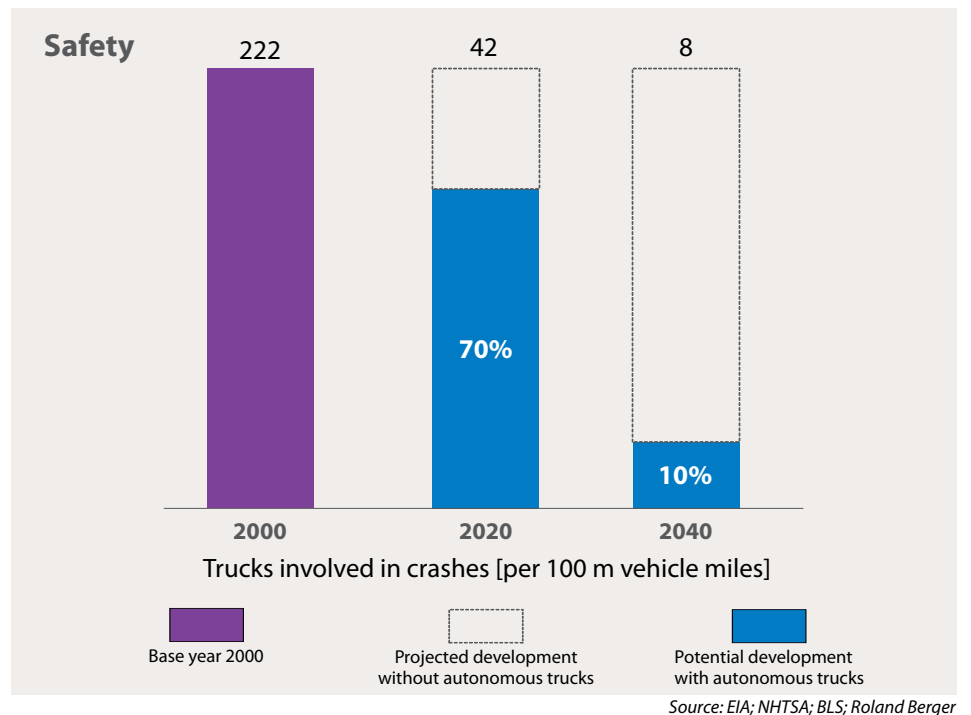


Figure 1: Impact of Driverless Trucking on Driver and Pedestrian Safety¹⁷

Greener Trucking is a Unique Opportunity

Driverless trucks will usher in fuel savings, a boost to the environment as trucking currently accounts for nearly 25% of pollution caused by transportation in the US. Close to 20% savings through aerodynamic platooning, truck-pooling, sharper speed governance, a complete lack of idle losses, uniform driving patterns such as automated manual transmissions, and low RPM runs will lessen the environment impact of trucking, improve driving performance and enable efficiencies. Using online analytical processing, on-the-fly engine tuning according to weather and terrain conditions will

aid in optimal fuel consumption and lessen repairs needed due to wear and tear. Figure 2 depicts this possibility.¹⁸

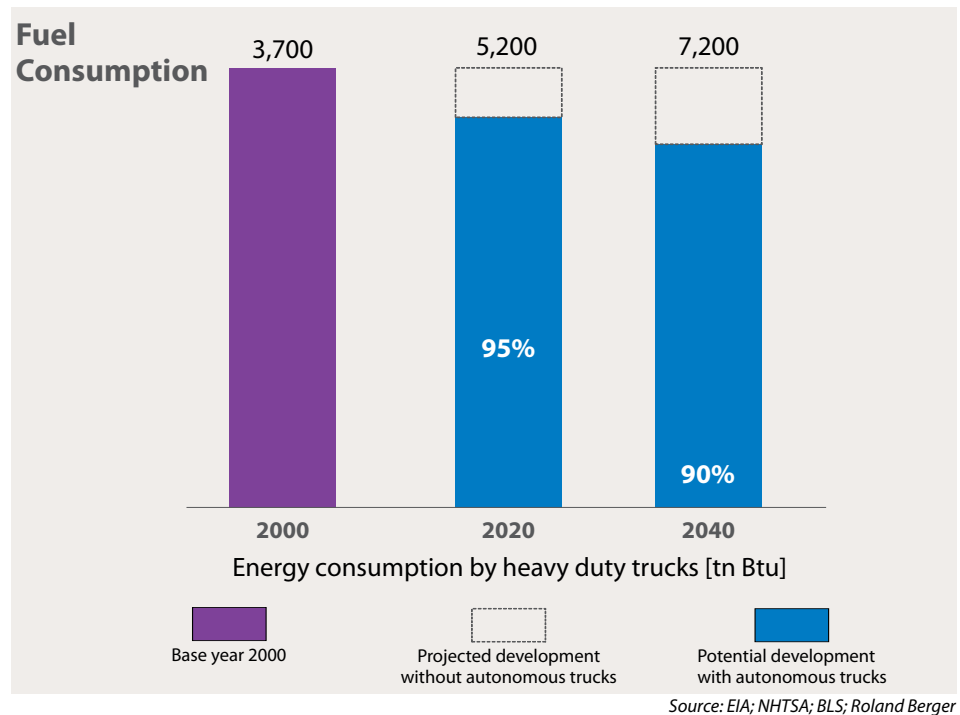


Figure 2: Impact of Energy Consumption on Driverless Trucking

AI driven vehicles are not yet intelligent enough to make judicious decisions in dilemmas and tricky situations such as whether to save the pedestrians or the nearby passenger bearing vehicles in case of a collision.

There are Still Bumps on the Road

Before driverless trucks become a common sight on the highway, there are numerous hurdles to overcome. To guarantee the safety of artificially controlled vehicles, and public confidence in them, a robust network of communication methods, sensors, radars, and map data must be in place.

Beyond the technical safety of driverless trucks, there are larger questions to be resolved about how autonomous vehicles deal with moral dilemmas, for instance, if there is an unavoidable crash.

Autonomous trucking will affect employment. Even though drivers are still likely to be needed for end miles of journeys not taken on highways and it is expected that more controller jobs may also be created, yet job loss is a sensitive issue that will require mature handling.

Prepare for Autonomous Trucking Now

To ensure future success, businesses must prepare their supply chain and logistics functions to embrace and prosper under the coming revolution of autonomous driving technology. There is a need to align the supply chain to fully exploit the advantages available which will include, not only reductions in the labour and fuel costs of trucking, but also a wider recalibration of logistics and a fundamental shift in the transportation of goods.

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- [17] ++m Vehicle Miles = million Vehicle Miles : calculated by multiplying the amount of daily traffic on a roadway segment by the length of the segment, then summing all the segments' VMT to give a total for the geographical area of concern
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