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**Truck transport industry in the USA: challenges and likely disruptions**

Amulya Gurtu

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## Truck transport industry in the USA: challenges and likely disruptions

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Amulya Gurtu

Austin E. Cofrin School of Business,  
University of Wisconsin-Green Bay,  
WI, USA  
Email: gurtua@uwgb.edu

**Abstract:** This study presents challenges and likely disruptive changes in the US trucking/logistics industry in the next decade and how these challenges and disruption might affect supply chain management, logistics management, and truck transport industries in the USA. This is a qualitative study based on interviews with senior executives from big transport organisations. The shortage of drivers and capacity constraints precipitated to be the main challenges, and blockchain technology is likely to be a disruptive technology. There seems to be a consensus among the executives interviewed on the use of fully autonomous Class-8 trucks (semi) on highways and city roads that it is too far in the future. The study is limited to the interviews of eight senior executives from four big transport organisations.

**Keywords:** logistics industry; logistics services; transport industry; supply chain management; strategic management; supply chain risk; autonomous vehicles; blockchain technology; electronic logging device; ELD.

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**Biographical notes:** Amulya Gurtu is the Chair of the Business Administration Department and an Associate Professor of Supply Chain Management at the Austin E. Cofrin School of Business, University of Wisconsin-Green Bay, Green Bay, WI, USA. His research interests include optimising supply chains, global operations, offshore outsourcing, and their impacts on the environment and societies. His research has been published in several journals. He is an Associate Editor of the *International Journal of Systems Science: Operations & Logistics* and on the international editorial board of the *International Journal of Strategic Management* and *Decision Support Systems in Strategic Management*.

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## **1 Introduction**

Logistics and transport activities are closely related to economic activities. The global economy has been growing steadily. Global logistics activities have been forecasted to grow in terms of volume and value due to the globalisation of supply chains. Transportation is a significant activity within logistics management and will also grow with logistics activities. However, transport activities in the USA heavily depend on the movement of goods by class-8 trucks, commonly referred to as semis. The trucking industry in the USA has many challenges, and its causes are intertwined. This attempts to understand the present challenges in the US trucking industry, likely disruptive changes in the next decade, and how these challenges and likely disruptions affect supply chain management. This is a qualitative research investigated through interviews of senior executives from transport organisations. The reason for choosing this method is the nature of multidimensional challenges, ambiguity, and exploration of the potentially disruptive changes in the future.

The global economy since 2008 has grown at a cumulative annual growth rate (CAGR) of 2.4% (World Bank, 2018). There is no indication of a slow down or a reversal in the world economic growth in the foreseeable future. Therefore, global logistics activities will grow, as well. The volume and value of the global logistics in 2015 were 54.69 billion tons and USD 8.2 trillion, respectively, and these are estimated to grow to 92.1 billion tons and USD 15.5 trillion respectively by 2023 (Transparency Market Research, 2016). This increase in logistics activities will affect transportation activities globally.

The US economy has grown at 2.7% CAGR between 2008 and 2017, which is higher than the global growth. Therefore, logistics and transport activities in the USA are likely to grow higher than the global projections. The logistics activities in the USA in 2015 were worth USD 1,480 Billion, which is about 8% of the entire gross domestic product (GDP). Of this, 8% of the G.D.P., USD 719 Billion, is in the truck transport industry (US Department of Commerce, 2017). In other words, the trucking industry cannot be ignored in the USA due to the dependence of the nation's economic growth on it. Assuming that the US truck transport industry's growth will be in line with the growth in the global logistics industry, the US trucking industry is likely to grow to USD 1,359 Billion by 2023. Trucks are an essential part of the US economy because the US economy depends on trucks more than railways. Railway tracks have reduced from about 397,014 miles in 1916 to about 161,240 in 2014 (Muller, 2019).

This paper is about the Class 8 truck (tractor-trailer) because most transportation in the USA is through Class 8 truck, also known as Semi. The most common length of the Class-8 trailer is 53 feet. However, the length varies from 8 feet to 57 feet. There were 3.68 million such trucks in operation in 2016. Another reason for paying attention to the truck transport industry in the USA is that truck transport contributed 81.5% of the entire freight revenue in 2016. The number of for-hire carriers and private carriers are 777,240 and 700,591, respectively, by June 2017. However, the trucking industry is highly fragmented as 91% of carriers have less than seven trucks, and 97.3% of carriers have less than 20 trucks (American Trucking Associations, 2018). The majority of such carriers are single truck operators. Despite such a large number of trucks, there is a shortage of drivers in this industry.

The shortage of drivers in the trucking industry in the USA has been acknowledged for a long time by many authors (Kemp et al., 2013; Schulz et al., 2014). According to the Occupational Outlook Handbook, US Bureau of Labor Statistics, the demand growth for Heavy and Tractor-trailer Truck Drivers is projected through 2026 at an annual rate of 6% (US Bureau of Labor Statistics, 2018). Academic research, trade association, and truck industry experts have acknowledged this shortage (Kingston, 2018; Raphelson, 2018). This indicates that the shortage of truck drivers will become more severe.

Many technological solutions have been proposed. However, many consider autonomous vehicles to be a technological solution to drivers' shortage. There are different views on the usefulness of autonomous vehicles in different applications. One of the views is that the current shortage of drivers is between 60,000 to 100,000 per year in the USA, which are estimated to be triple in number by 2026, and autonomous vehicles have the potential of eliminating about 300,000 driver jobs per year (Kenwell, 2018). The implementation of new technological devices called electronic logging device (ELD) is further adding to the capacity challenge. Big organisations have used ELD for quite some time. However, mandating it for all affects the capacity, which will be further discussed later.

ELD has been introduced to control the driving hours for the drivers' safety and others on the road. This came into existence as a rule on December 16, 2015. It is being implemented in phases. Phase 1 was about generating awareness and transition, which ended on December 18, 2017. During this phase, the use of an ELD was voluntary. Phase 2 was phase-in compliance until December 16, 2019. During this phase, the use of ELD is mandatory. However, using an existing Automatic On-Board Recording Device (AOBRD) instead of ELD is acceptable. Phase 3 is full compliance from December 16, 2019 onwards, i.e., a proper ELD will be required on every truck beyond December 16, 2019 (USDOT, 2015).

A few other factors, such as salaries in other comparable professions, lead to the driver shortage and parking spaces on highways, making the situation worse. The problem of the shortage of parking spaces and parking violations have been acknowledged by many authors (Boggs et al., 2019; Boris and Brewster, 2018; Corro et al., 2019). "90% of drivers parked in an unauthorised location at least once a week" (Boris and Brewster, 2018). "Approximately one-third of the collisions on interchange ramps had a parking facility utilization rate of 90% or higher, and 23 ramps (15.8%) were adjacent to parking facilities that were at or over-capacity" (Boggs et al., 2019). These will be discussed later and explained their interlinkages.

Further, this paper will explore some of the technological advancements that can potentially disrupt the trucking industry. The remainder of the paper is organised as follows. Section 2 discusses the research design and the motivation behind this research. Section 3 presents analyses and discusses the findings. Section 4 discusses the impact of supply chain management, and Section 5 concludes the discussion with some limitations and recommendations for further research.

## **2 Research design**

The suitability, importance, and advantages of qualitative research has been discussed by many authors (Bansal and Corley, 2011; Barnham, 2012; Gephart, 2004). This paper employs a qualitative research method due to the nature of the study. The purpose of this

study is to understand the present challenges in the US trucking industry, the likely disruptive changes in the next decade, and how may these challenges and disruptions affect supply chain management. Such insights can be gathered from leaders in transport organisations. A qualitative study appears to be a more appropriate tool for this study. A quantitative study, such as a survey, does not seem appropriate for this type of study due to a small sample size because the finding will not be statistically valid. The executives' interviews are considered a valuable tool for gathering insights on issues of strategic importance (Says, 2016; Schoenberger, 1991). Qualitative research methods include interviews and focus group study, among others (Ghadge et al., 2012). Therefore, semi-structured interviews have been used for this study to get insights. Further, the findings were cross-verified with the same executives using the Delphi technique (San-Jose and Retolaza, 2016).

The interview is a well-established technique to gain insights where the sample size is small and/or a more in-depth understanding is required. This is employed independently and after a quantitative study to verify and/or deepen the findings (Bode and Singh, 2018; Söderberg et al., 2013). Interviews are used to develop a survey and improve the quality of a questionnaire for a quantitative study (Martinez-Noya et al., 2012). In a study on sustainability in logistics in South Korea, authors conducted interviews with experts after a qualitative survey to gain meaningful insights (Kim and Lee, 2012). An early definition of SCM was developed from executives' interviews in 2001 (Stock and Boyer, 2009). Interviewing as a tool is used in many other situations and many other industries.

Another example is for finding the location of outsourcing in the banking industry. More interestingly, interviews were conducted in the finance industry to validate the finding from interviews in another country in the finance industry (Grote and Täube, 2007). Another example is the use of interviews in finding the critical success factor for sustainable supply chains (Gopal and Thakkar, 2016).

The study is focused on the trucking industry in the USA. However, it may have some similarities in other geographies, and the likely disruptive changes may affect other geographies. The insights were collected individually from eight senior executives from four big transport organisations. Each organisation falls in the top 3% of the tuck/logistics organisations in the USA. The executives' and organisations' names are not shared due to confidentiality reasons. One of the organisations ranked among the top ten trucking organisations in the USA, the rank of another organisation is between 60 and 70 in the USA. The third organisation's rank is between 130 and 140 in the USA. The total number of tractors, trailers, and drivers managed by these three organisations collectively in 2018 were approximately 17,000, 53,000, and 18,000, respectively. The collective revenue of these three organisations in 2018 was more than \$5 trillion (CCJ, 2019). The fourth organisation is a similar large but privately held organisation. The executives from this organisation do not want to share this information publicly. The statements of the executive interviewed are combined as generic statements or themes. However, a few powerful verbatim quotes are also provided. Each executive was asked the following three open-ended research questions (RQ):

RQ1 What are the current challenges in the industry?

RQ2 What are the likely disruptive changes in the industry in the next 5 to 10 years?

RQ3 How may supply chain management be affected by these challenges and likely disruptions?

Each discussion lasted for about one hour with each executive separately. After completing the first round of all interviews, findings were consolidated into categories based on the topic. These consolidated findings were further reviewed with each of the executives for their comments. Since these were consolidated findings, some executives did not agree with a couple of findings and provided their rationale. This step was repeated one more time to bring robustness to the findings. Their inputs were refined and consolidated. The anonymity of individuals and organisations was ensured at every stage to avoid any influence of a leader or an organisation on others' thoughts or insights.

As the last step, the paper's final draft was sent for review to each of the executives for providing any observations and comments. These observations and comments were addressed before submitting the final manuscript. The next section analyses and discusses these findings.

### **3 Analysis and discussion**

This section has been divided into three sub-sections analysing and discussing each question in detail. The first section is on challenges, the second section is on likely future disruptions, and the last section is on its impact on SCM.

#### *3.1 Challenges*

There are two main challenges, which are intertwined in nature. These challenges are shortage of drivers and capacity reduction. A shortage of drivers will cause a reduction in capacity. However, there are other reasons for this reduction, which will be discussed later. Some believe that reducing capacity is cyclical and transient and will go away in time (Bearth, 2018). However, it is currently amplifying the issue of the shortage of drivers. Therefore, this is further divided into two sub-sections: driver shortage and capacity reduction. The next two sub-sections will answer *RQ1: What are the current challenges in the industry?*

##### *3.1.1 Driver shortage*

The paper has partly discussed the shortage of drivers earlier. The reasons for truck drivers' shortage are the aging population of drivers, changes in demographics, and truck-driving as a career is no longer attractive than other career choices. It is important to mention that one cannot become an interstate truck driver directly after graduating from high school. One has to have a minimum age of 21 years to drive a truck across state boundaries. The government has recognised this and is considering lowering the age to 18 years to drive a truck across state boundaries (Long, 2018). It was surprising that a person is considered mature enough to decide a nation's fate by voting for a candidate but is not considered mature enough to drive a truck. This could be due to historical reasons that the voting age was 21 years until the 26th amendment in 1971 (The Constitution of the USA, 2019).

Compared to many other jobs such as a plumber, an electrician, a carpenter, trucking is a difficult job that requires a driver to be on the road for days away from family and friends. The salaries of truck drivers are no longer as attractive as two or three decades ago.

Truck drivers' job is more demanding than many other similar paying jobs. Generally, employees intend to quit (ITQ) a job due to the relationship with top management and/or colleagues. Surprisingly, a study on truck drivers' turnover showed that "drivers' attitudes toward top management and dispatchers did not influence I.T.Q." (LeMay et al., 2013). This finding could be because drivers do not regularly interact with top management than other corporate jobs.

Another reason for the shortage of truck drivers in the USA is that millennials are not interested in this career because of working hours and a different lifestyle. They prefer an alternative job that does not have such a sedentary effect (NextExit Logistics, 2018). The long hours behind the wheel, limited time off, a lack of comfort and time away from family and friends are neither attractive nor lucrative. The younger generation prefers a greater work-life balance than previous generations (Betts, 2018). As mentioned earlier, the salaries are no longer attractive than many day jobs such as plumbers, electricians, or carpenters, which can motivate someone to take up a relatively demanding and challenging truck-driver career.

### *3.2 Capacity reduction*

This sub-section talks about reasons other than the shortage of drivers, causing a reduction in capacity. One of the reasons for a reduction in truck transportation capacity is some changes in legislation on driving hours. Safety on the road is the most important thing for drivers because any relaxation in safety could have severe consequences for drivers and others' lives. However, truck drivers experience time pressure when on roads to deliver goods. Being away from families and friends causes emotional stress, which puts them under pressure to return home as soon as possible. Both these situations, i.e., when going to a destination and returning home, cause a sense of urgency among truck drivers on roads to reach on time at the destination and reach home as quickly as possible. A survey of 435 professional drivers indicated that truck drivers tend to give less priority to safety due to the fatigue of driving and emotional stress (Kemp et al., 2013). Similar efforts have been made in other parts of the world with some variations. For example, the European Union has limited driving time to 56 hours in a week and 90 hours in the fortnightly, bringing the average driving time to 45 hours per week.

Further, a driver can drive for a maximum of 9 hours per day. However, a daily maximum is allowed up to 10 hours twice a week (European Commission, 2016). I want to clarify that I am not advocating for reverting these changes in driving hours because these changes are for the safety of drivers, equipment, goods being transported, and fellow drivers/passengers who share the roads. The changes in driving hours are worth welcoming because they save lives. Nonetheless, it causes a reduction in overall capacity.

As mentioned earlier, an ELD enforces the driving time very stringently, and a driver/transporter can be heavily fined for not adhering to the driving hours. The demand for parking spaces has increased due to the strict enforcement of driving hours (Corro et al., 2019). Imagine that the driving time left for a driver on the road is only one hour, and the next rest area is two hours away. A driver's choices are limited to taking a break at the rest area now, taking an exit after about 45 minutes, finding a safe parking place, or getting penalised, which is not a real option. The first two options will reduce capacity, besides finding a parking place, especially in winter months, is not easy. Many drivers park their trucks on exit ramps or on the road to meet driving hours' requirements. Parking on ramps or roads is a safety concern, particularly during low visibility.

However, they do not have an option to drive it to a safe place without breaking the law of driving hours or further reducing capacity. Drivers used to stretch a few minutes to reach the destination and complete the journey. However, an ELD does not allow an exception for a few minutes, resulting in a reduced capacity.

Despite many challenges due to the capacity constraint, there is an opportunity to improve the coordination and cooperation between shippers and carriers. This has the potential of improving operational performance (Fugate et al., 2009).

### *3.3 Likely disruptions*

Two leading technologies have the potential to be disruptive in logistics. These are autonomous vehicles and the blockchain technology, which will be discussed in the next two sections answering *RQ2: What are the likely disruptive changes in the industry in the next 5 to 10 years?*

#### *3.3.1 Autonomous vehicles*

Many truck manufacturing organisations have been developing autonomous vehicles. A step in that direction was moving trucks together with a network called platooning. A consortium of European truck manufacturers consisting of D.A.F., Daimler, Iveco, M.A.N., Scania, and Volvo had successfully tested truck platooning to reduce maintenance and operations costs (Gurtu et al., 2019). However, platooning is not permitted in most of the states in the USA (Adler, 2018). It is hoped that this situation will change due to the advantages of this technology. Platooning technology does reduce fuel consumption and emissions, but it does not address the issues of driver shortage and capacity reduction. A change in the legislation of hours of duty legislation that a driver would be considered off duty while platooning may help address drivers' shortage. I do not see an appetite for a change like that in the near future.

The next stage of automation is a fully autonomous truck. All the executives interviewed from the logistics organisations were unanimous in echoing that an autonomous vehicle without a driver either on long haul or on city roads is far from the reality in the next decade or two. One of the very senior executives with over 30 years of experience said, "it will not happen in my lifetime". However, Tesla is coming out with a class 8 truck (Gurtu et al., 2019). It has 'auto-pilot' capabilities, but it cannot be called autonomous because it needs a driver during operation. Therefore, a Tesla truck is not truly an autonomous truck on highways and city roads.

Autonomous vehicles will not solve the driver shortage because each truck needs a physical driver (Rajamanickam, 2019). The executives also mentioned that autonomous vehicles would be more appropriate for use in areas not open to general traffic besides being controlled and monitored by an organisation such as a port or a large warehouse. Further, autonomous vehicles might motivate millennials to consider truck driving as a career due to the comfort in driving an autonomous semi or a desire to drive a high-tech vehicle, which may indirectly address the shortage of drivers and capacity constraints. Nonetheless, an autonomous vehicle will not solve lifestyle or be 100% alert while on the road. Another reason for the autonomous vehicle being far from reality is the optics of an accident by an autonomous vehicle and its impact on public opinion. The capabilities of an autonomous vehicle in inclement weather are limited because LIDAR sensors are a barrier to mass adoption. The cost of the radar has to come down significantly for the



economic viability of such vehicles. As stated earlier, unless there is a legislative change in off duty time, it does not address the shortage of drivers on highways and in cities. Another barrier to using autopilot is the need for an excellent infrastructure. For a truck to remain in the lane, clearly visible lane markings are needed. Vehicle to infrastructure deployment coalition (V2I DC) is an initiative to discuss and meet the needs of the infrastructure for autonomous vehicles (National Operations Center of Excellence, 2019).

### 3.3.2 Blockchain technology

Data security is the biggest challenge for every industry, and none seems to have found a solution, which is 100% hack-proof. The blockchain is the technology that makes transactions safe, secure, and hack-proof. The World Economic Forum (WEF) has characterised the blockchain as one of the six megatrends in computing that are likely to shape the world in the next decade (World Economic Forum, 2015). Blockchain technology is considered the most significant innovation in computer technology (Gurtu and Johny, 2019; Tapscott and Tapscott, 2017).

One of the highest costs in the transport industry is the cost of reconciliation of transactions. It varies from 10% to 22%, depending on the supply chain (Amber Road, 2019). The cost of reconciliation does not add any value and should ideally be zero. The blockchain technology is expected to bring down the cost of reconciliation to near zero, if not eliminate it. This cost is a waste, and eliminating this step will make payments and auditing lean. The jobs of shippers/consigners are not driver-friendly due to the high cost of drivers, which is increasing. The blockchain improves the visibility of supply chains and helps in better scheduling of trucks and drivers. Many process steps between order generation and delivery at the destination will be eliminated due to built-in security in the blockchain databases. Blockchain technology will increase the supply chain's visibility and reduce transaction costs (Gurtu and Johny, 2019).

The blockchain has the potential of providing a platform for small transporters to compete without going through the intermediaries. On the one hand, it may eliminate intermediaries, and on the other hand, it may lead to consolidation of the highly fragmented trucking industry. The role of intermediaries will be nearly eliminated from the trucking industry the same as the role of stockbrokers has been nearly eliminated from dematerialisation (DEMAT) of stocks and instant online trading of stocks. The next sub-section will discuss the impact of these changes on SCM.

## 4 Impact on supply chain management

Challenges and likely disruptions do not have a one-to-one correlation. However, some technologies may influence these challenges party. Transportation is an integral part of SCM and a high cost within SCM. The shortage of drivers and capacity constraints will increase the cost of every supply chain as truck transport is an essential component of almost every supply chain. This will push transport managers to explore intermodal transport solutions instead of trucking alone, and traffic on rail routes will increase. Truck operators will prefer efficient loading and unloading trucks because the time of loading and unloading is counted as working time and affects driving time. More and more truck transport organisations may start penalising heavily in case of a delay beyond the

specified time. In other words, an organisation that is more efficient in loading and/or unloading may get preferential treatment and better rates for being efficient.

Since there is a shortage of trucks on the road and it takes longer to move between two points, the SCM professional will have to plan for orders, receiving, and dispatch more precisely so shippers can organise trucks well in advance. In cases where this planning and organising trucks in advance is not done accurately, manufacturing may be required to shut down due to a lack of space for keeping finished goods.

The current challenges, coupled with a new technological option, may transform the trucking industry from highly fragmented into highly organised. This will present another challenge for the SCM professional to deal with big organisations most of the time. The advantage of getting better prices from single-truck operators may be minimised. As explained earlier, many single truck owners/drivers used to travel a few minutes extra than allowed to complete the trip on the same day. This is not possible with ELD and will take one extra day for the delivery. The cost of an extra day will be passed on to the ordering organisation, i.e., the transport cost will increase significantly. In the long run, this will lead to finding vendors and distributors at fewer distances that take nearly multiple of a full-day of travel. In other words, the supply chain may undergo a change based on the travel distance, and preferences will be given to regional/local organisations. This sub-section responded to *RQ3: How may supply chain management be affected by these challenges and likely disruptions?*

## 5 Conclusions

The purpose of this study is to understand the present challenges in the US trucking industry, the likely disruptive changes in the next decade, and how may these challenges and disruptions affect supply chain management. The challenges of the driver shortage and capacity reduction complement each other and compound the challenges. There does not appear to be a solution to this situation in the short term. However, a change in the accuracy of planning and an improvement in shipper and consignee execution efficiency will address these challenges in the long term.

Transport organisations have been increasing truck drivers' salaries and offering various incentives to attract and retain drivers, which will continue. They will also develop routes and change plans so that drivers return home every weekend in the short term, with the long term objective of ensuring their return every day. In the meantime, this will require another layer of complexity in SCM while the cost of transportation will go up. In other words, either the profitability of organisations will be affected, or the prices to consumers will increase.

The autonomous vehicles are likely to alleviate some pressure in a well-controlled and closed environment but unlikely to relieve the driver shortage or capacity constraint for long-haul or city routes. The blockchain has the potential to bring down the cost of transportation by offsetting the cost of reconciliation. However, many organisations must adopt the blockchain technology to feel its advantages. The use of blockchain by many organisations requires a lot of computing power, server network, and agreement among various parties. Therefore, it is likely to take around ten years before its benefits are experienced.

Generalising an interview-based study out of context is neither recommended nor appropriate (Qu and Dumay, 2011). Therefore, one of the limitations of this work is that it is based on interviews with executives from the USA transport and logistics industries. Only a few findings can be generalised in other geographies. This study was done before the global pandemic COVID-19. Somethings may change once this crisis is over. The trucking industry structure may not be in the same condition in other nations, limiting this study's suitability to other nations. This can be extended by surveying executives from other countries to study and see the similarities and differences and scalability of findings.

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