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Sociotechnical Dimension of Trucking in India: Possibilities for Digitalization

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Abstract. India as a country is rapidly changing due to an influx of Information and Communication Technologies (ICTs). The impact of ICTs has been felt on far-flung areas ranging from agriculture to industry. In this chapter, we highlight possible ways in which ICTs can be included in the trucking sector from the bottom-up. In order to accomplish our goal, we present an ethnography with a sociotechnical dimension. Specifically, we recognize that large-scale social systemic challenges shape individual actions in the technological trucking sector. The ethnographic study comprised of semi-structured interviews with over 30 stakeholders, was conducted in the metropolitan port city of Mumbai, India. It was aimed at understanding the functioning of the sector, current practices, roles of stakeholders involved, and the challenges faced by them. The results are followed by a discussion that deals with the impact new information technology is having on the sector and identifies areas for future intervention.

Keywords: Digitalization, Sociotechnical Systems, Ethnography, Symbolic Interactionism, Mumbai

1 Introduction

“Truckers are, after all, the blood vessels that course through the body of our nation, ferrying the oxygen of essential goods on the arteries that are our highways. And yet their problems had not so much as received a diagnosis, forget diagnosis, their symptoms had not been recorded. Countless reams of newsprint have been consumed in op-ed articles on the economy that discuss interest rates, fiscal deficits and other such arcane macroeconomic indicators. But what is this ‘economy’ they talk about, but an assemblage of countless transactional relations anchored in a system of mutual acceptability, i.e., money changing hands... I believed that the lived reality of truckers, their experiences of the road, would be a useful barometer of the economic health of our nation. The nature of their encounters with state officials would shine a light on the reality of rule of law in our country. It would be helpful in understanding what the ‘cost of logistics’ actually means in the course of routine transport.”

– Rajat Ubhaykar.[1, p.7-8]

Digital transformation in the trucking sector in India can take place along two different directions simultaneously. First, the trucking infrastructure will change due to

embedded technology and sensors manifested in the form of improved combustion efficiency, reduction of emissions, monitoring the health of parts, and others. While improvements in this area happen with the development of technology, this approach towards digitalization is primarily manufacturer-driven. In the second direction, existing technology can be augmented through the change in the digital habits of the humans associated with this sector. In this direction, the focus is on how humans in the trucking sector adapt to and make use of the ICTs. Specifically, in a country like India, the use of IT through mobile phones plays a major role in the adoption of digital services and in changing the trucking sector.

This chapter explicates how the trucking sector operates in India in relation to the various roles involved in the trucking industry such as drivers, brokers (*mehtas*, *seths*), owners, and helpers (*khalassis*). This understanding of the sector provides an opportunity to gain a sense of digitalization starting from a bottom-up fashion. The chapter is divided into six sections: Section 2 lays out the challenges of trucking and digitalization in India. Section 3 provides the theoretical backdrop of Sociotechnical systems and frames the direction for the fieldwork in the next section. Section 4 lists the details of the fieldwork and Section 5 presents the results. The chapter concludes with Section 6, a discussion of possible avenues for digitalization of the trucking sector.

2 Trucking and Digitalization in India

India as well as other low and middle income countries are undergoing a rapid transformation in the area of information technology. In the future, with the development of cheap electronic hardware, it is expected that several technologies such as sensors will be embedded in everyday objects transforming everyday interaction with devices. Some of this transformation is depicted in the form of cellphones which is transforming the Indian masses towards digitalization and use of ICT. Given this milieu, there is a need to understand how the trucking sector will deal with this sociotechnical transition of ICT. The trucking sector in India involves a few fundamental challenges. Here, we list a few major challenges and how they need to be contended with in terms of addressing the socio-technical dimension of this sector.

First, the trucking sector involves three major categories of service providers — large companies with a line of trucks; small fleets ranging from 5 to 40; and small-scale truck owners having less than five trucks. While major truck companies have the means to embrace information technology, medium-scale and small-scale truck operators will face significant challenges.

Second, many stakeholder segments in the sector have low literacy. A recent study [2], indicates that a majority of truck drivers are educated up to grade 10 of high school or less. The helpers who are in the truck and are involved in sundry roles, also have low-literacy levels. In most cases, the small-scale truck owners may also have low literacy.

Third, barring the large companies, the sector is highly dependent on the restricted flow of information in terms of receiving and providing services. For example, the “*mehtas*” and “*seths*” are information and service brokers who act as mediators between the clients and truck owners. Thus, prices, routes, and movement of goods are heavily dependent on the information flow in this sector.

Fourth, with the growth of cheap cellphone technology, this sector like many others in India is changing in the way it communicates. In a country such as India, due to the low level of technological development and adoption among the masses, Information Technology in the form of computers never constituted a major wave of digitalization. However, with the advent of cheap cellphones, the Indian is rapidly up taking digital tools and practices in their everyday lives. The Government of India recognizes this change and has set up steps to bring digitalization close to the everyday lives of Indians. In terms of the cellphone, it serves as a primary means of communication along with media consumption and economic transactions, making the cellphone an enabling technology in the life of an everyday Indian. In the trucking sector, the cellphone serves as the major route of the transformation for negotiating deals and prices.

While the list of challenges to digitalization can be extended, this chapter aims to recognize digitalization as a sociotechnical endeavor. Specifically, the aim is to understand how the trucking sector works so as to provide pathways for digitalization. Towards this end, the chapter focuses on human knowing and acting in the trucking sector using a conjoined theoretical approach of socio-technical studies and symbolic interactionism developed in section 3. The aim of the analysis will be to use an ethnographic approach using symbolic Interactionism (SI) while being mindful of the four tenets derived from STS theory in the next section 3.

3 Theoretical Backdrop of Sociotechnical Systems and Symbolic Interactionism

Sociotechnical Systems (STS) theory has a wide history and multiple usages developed across almost the past five decades [3]. There is no one specific direction in which the growth of STS can be charted; multiple viewpoints still exist in the literature. One direction in which STS theory has been developed is derived from British researchers and the Tavistock institute [4,5]. This school of thought provided a key idea which was, to understand and improve tasks related to technologies, the context of work and the social dimensions of the activity were necessary. These researchers developed STS theory in several milieu ranging from coal mining to textile manufacturing. This approach to STS was also prominent amongst macro ergonomics, work psychology, and human factors researchers and still remains an active area of research [6,7,8].

A second direction was derived from risk management and systems engineering [9,10]. In this approach, the key idea is to recognize that technical systems involve people and technologies along with social entities such as teams, organizations, and institutions at several levels of abstraction. Therefore, to comprehend and optimize STS all these together as a unified construct. As a result, this direction in STS emphasizes

that any construal of an STS involves the social as having an impact on the technical. Therefore, any analysis of behavior should involve an understanding of broader aspects of social, economic, and political dimensions of the work domain under consideration.

A third direction of STS analysis derives from the history and sociology of technology [11,12]. In this direction, the key idea is to treat STS as a hybrid of social and technical entities. In this thread similar to the previous direction, the social and political dimensions are recognized to be necessary. However, in this direction, the social is treated not as separated but conjoined and mutually constitutive of the technical. In other words, technology has evolved based on choices people have made in light of their relevant social groups. Therefore, while there is a technical trajectory, there is co-shaping by a social trajectory that together defines have been co-constructed socially.

While all these three approaches provide different aspects to the construal of the human-technology interaction in STS, a final direction is needed to comprehensively understand how people interact with technology in context. In the field of Human-Computer Interaction (HCI), researchers have turned towards micro-sociological theories to understand how human behavior can be addressed in human technology interaction. One approach has been that of Symbolic Interactionism (SI) and is particularly important for HCI. SI was developed in the discipline of sociology at the beginning of the nineteenth century to understand how people make sense of themselves and the world around them. It rests on three basic premises that provide a basis for how human beings interact with their surroundings (which in our case is the social and technological context).

“Symbolic interactionism rests in the last analysis on three simple premises. The first premise is that human beings act toward things on the basis of the meanings that the things have for them. Such things include everything that the human being may note in his world—physical objects, such as trees or chairs; other human beings, such as a mother or a store clerk; categories of human beings, such as friends or enemies; institutions, as a school or a government; guiding ideals, such as individual independence or honesty; activities of others, such as their commands or requests; and such situations as an individual encounters in his daily life. The second premise is that the meaning of such things is derived from, or arises out of, the social interaction that one has with one's fellows. The third premise is that these meanings are handled in, and modified through, an interpretative process used by the person in dealing with the things he encounters”

– Herbert Blumer [13, p.2]

Further, to fully comprehend these meanings, we need a qualitative approach to capture and comprehend how these meanings evolve over interaction with technologies. This qualitative approach is obtained through an ethnographic process that aims towards comprehending the meanings and values of people and their relevant social groups as viewed from their own viewpoint.

Based on the above discussions, four key insights can be summarized for developing this chapter. In the rest of the chapter, these four key insights will be used to guide the ethnography in the trucking sector in India:

1. The social and interpersonal dimensions of human behavior are important for comprehending human-technology interaction in STS.
2. Humans in technological environments are constrained by macro-social dimensions of organizational institutions in any particular sector.
3. Human technology interaction involves a conjoined understanding of both the social and technical dimensions of the system as they are hybrid entities.
4. Finally, to understand human-technology interaction, we need to understand how interaction is shaped through meanings and values in a given social milieu.

4 Details of Fieldwork

4.1 Setting

Mumbai is a major port city and serves as the western conduit to the Arabian Sea. Therefore, Mumbai serves as a major hub for the transfer of goods to and from inland India. The fieldwork was conducted at the truck yards in *Vashi* and *Wadala* (Cotton green) in Mumbai suburban region. These locations were chosen for study as they are the primary trucking spots that connect Mumbai to the rest of the country.

Wadala truck yard is situated at the edge of Cotton Green railway station on a barren strip of land with a lot of warehouses. There are 6 different lanes with multiple entrances to them and each entrance is manned by parking lot officials. Different lanes are for trucks from different locations. The trucks in this yard are those that mostly run within Mumbai and the yard also happens to be a warehouse for a steel company.

Vashi truck yard is located 4 kilometers away from the *Vashi* railway station is a well-organized place, unlike the *Wadala* truck yard. It has only one entrance and one exit. It has an integrated petrol pump and food joints in the vicinity. One can also find a lot of truck repair shops in the yard, making this a perfect place for drivers to stay for a long time safely. The trade-off is a higher parking fee. In the *Vashi* truck yard, long-haul trucks were predominant.

4.2 Participants

The research study was granted ethics clearance from the Institute Ethics Committee, Indian Institute of Technology Bombay (ID: IITB-IEC/2020/021). In all, there were more than 30 participants which included a wide variety of drivers, brokers(*mehtas*, *seths*), parking officials, transport agency personnel, among others. For example, the drivers whom the researcher met at the truck yards in Mumbai hailed from all across India and they took consignments all across the country as long as they saw profit in it. These included far-flung areas such as the southernmost state of India- Kerala, and the northernmost tip of the country- the union territory of Jammu & Kashmir. They cover almost all regions in India except for the extreme North East.

4.3 Duration and process

The entire fieldwork lasted for around two months and was conducted from Jan-Mar, 2020. Semi-structured interviews and observations were used as a primary means of data collection. The first two weeks were spent observing and having informal discussions with the participants to understand the whole ecosystem of the trucking industry in Mumbai. Once there was a clear picture of the trucking industry as a whole, a more detailed set of interviews were conducted for the remaining period.

The time frame for interviews varied from a few minutes to one hour depending on the interviewee's availability. There were days in which the researcher interviewed just a single person and there were days where he could interview 6-7 people. Finally, there were also days that were spent completely on observing the activities instead of interviewing. With the permission of the interviewees, some discussions were recorded in audio format. This proved to be fruitful especially during casual group chats with drivers, where it was impossible to take mental note of everything and write it down later. When it seemed possible, drivers were probed to reveal their little secrets. The insights derived from the participants were gleaned using categorization and coding. Codes were developed bottom-up from the notes and interviews. The key idea in ethnographic research is to start from individual instances and, based on the data, inductively provide generic themes and insights for this sector. Based on this analysis, the major generic themes are developed in Section 5 as results.

The entire fieldwork was conducted by one field researcher. This ensured that a more reliable and clear engagement with primary sources. These insights were interpreted with the help of two mentors and another researcher (also authors in this chapter) who have been working in this sector, as well as, supplemented by secondary literature currently present about this sector.

4.4 Engagement

“I used to casually talk to the drivers and a major breakthrough happened one day when a driver actually invited me to join in for a tea break along with other drivers. That chat session lasted for an hour and from the conversations between the people, I understood a great deal about their view of the world/system and the problems they face. On another such occasion, I happened to be with a group of drivers who were getting the papers cleared by a *mehta* for a trip. That day, I understood the social hierarchy and the limited control/information drivers have about their consignments.”

— Field researcher, *Reflections on fieldwork*.

A primary challenge during the study was that people were not ready to open up to discuss the details once they heard that this was a “formal research study”. A major challenge with conducting research in this sector is that, in general, a number of participants do not wish to be recorded (audio and visual) or even give their signatures on consent forms. They provided verbal consent and provided their insights in length but were unwilling to sign forms. As a result, the major focus was on taking down notes which was then used for data analysis to highlight general themes depicted as results in section 5.

Further, a significant reason for this was the language barrier and distrust of any outsider who does not provide any monetary value. Most people would say that they are not at all interested to talk after being given a brief introduction about the research. However, after an initial fallow period, contacts were made and this made the detailed set of interviews possible. Once a general sense of the trucking sector was obtained, the interviews were structured and as the study progressed, questions were more in the form of probes to get more ideas about specific aspects. This method was continued throughout the remaining period of the study and slowly a unified picture emerged.

5 Results: Trucking as sociotechnical processes

The sector deals with literally anything that can be moved— food, machinery, hardware, or any other miscellaneous items. Truckers traveling within a particular state tend to carry vegetables, perishables, or other similar FMCGs. Long haul trucks ferry a range from raw materials and machinery to organic materials, which perish within 2-3 days. There are a few trucks with cold storage and they carry goods like ice-creams and other beverages. Based on the delivery priority, goods can be classified into:

1. Express delivery (to be delivered within 2-3 days)
2. Normal delivery (delivered within 1-1.5 weeks; timeline varies when heavy machinery or fragile equipment are involved, as driving speed is lower in such cases)

The kind of clients the sector encounters range from someone who wants to send two boxes to companies that ship multiple truck loads. Similarly, on the truck ownership side, there is a lot of diversity with a lot of small players involved. Hence, there is a need for an intermediary whom the parties on both sides can rely on for continued business. This role is taken up by 'transport agencies' through which all flow of goods take place. Only in 2-3% cases do clients directly deal with a truck owner [14].

5.1 Transport agencies and the functioning of the sector

Transport agencies. Transport agencies in this sector are quite diverse. They can be broadly classified into:

1. Corporate entities: They have their own truck fleets that can be as large as 5000 trucks, their own warehouses and full-time drivers with fixed salaries.
2. Medium-sized transport agencies: They do not have their own trucks and are dependent on a network of middlemen/brokers to find trucks for the consignments. Some of them do have their own warehouses/storage areas.
3. Tea-stall sized transport agencies: They own neither a truck nor a warehouse and due to the low volumes, deal directly with the drivers of the trucks.

While the corporate players offer end-to-end services, they form a small portion of the market share with only 10% of all trucks belonging to players owning more than 20

trucks [15,16]. As a result, it is the domain of the smaller players that has gained our attention.

Functioning of the sector. In a typical scenario, a client calls up a transport agency and gives them the details of the consignment that needs to be shipped. The goods are collected and stored at the warehouse/office of the transport company. In the meantime, one can find a lot of trucks at the truck yard that have registered themselves as 'available for a trip' with the transport company and are waiting for a consignment. Once the consignment is assigned to one of these trucks, they pick up the goods and leave for the destination. In case a transport agency does not have storage space, the goods are directly picked up from the client's *godown* (warehouse).

In the event of the drivers not getting a consignment that is not a full load, they try to take multiple consignments on a single trip. The field researcher, for example, met drivers from Kerala who were willing to wait 2-3 days to get one more consignment if a single consignment does not fill up the cargo space. After delivering the goods, the truck usually returns empty as they would not be able to find a return trip immediately (also see [14] for a similar point). Moreover, the drivers of these trucks are usually paid based on the income generated by the truck; hence, the faster a driver can return home and get registered with a transport agency for the next trip, the more money he makes. It is also possible that a single truck can be registered at more than one transport agency. For the time during which the truck is at the yard waiting for a consignment, which might take days together, a 'parking fee' is levied on a per-day basis. Hence, in many ways, time is directly linked to money in the everyday functioning of this sector.

5.2 Stakeholders and the social hierarchy

Truck owners. Among the trucks at the yard, one can find the following variety in ownership:

1. Trucks of corporate logistics companies
2. Owned by *maliks* (owners having small fleets of 10-50 trucks)
3. Partnerships between *maliks* and individuals
4. Owner-cum-driver

While large companies that have their fleet of trucks often involve an impersonal system of management, smaller owners like the *Maliks* generally tend to be someone related to the trucking industry in some form like an ex-driver, a mechanic, a broker, a business person who regularly needs a truck to transport things or someone for whom it is their family business. Over 70% of owners have been associated with the sector for more than 10 years [2, p.11]. There also exists a class of drivers who own their own trucks and make up for 6% of total truck ownership [2, p.3]. These drivers are aware of the technicalities of the sector, the truck and its components, but might not be comfortable with abstract technical terms. Although the truck owners have greater power compared to drivers, they do not interfere much in the administrative or monitoring activities of the sector and leave it to the driver to take care of the day-to-day activities. The

truck owners' level of education can vary from primary school to sometimes even a university degree, though the average stands around a secondary or higher secondary school education.

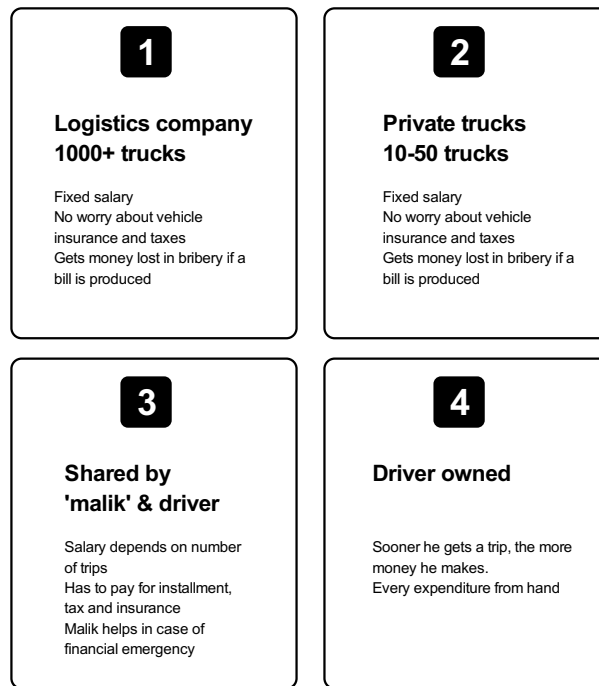


Fig. 1. Truck owner categories

Mehta (broker 1). *Mehtas* are clerks who are responsible for clearing all the paperwork for a consignment which includes road permission, luggage insurance, and other documents like bills. All these documents (insurance included) have been made mandatory by the government and the goods can even be seized by law enforcement for not carrying them. Usually, *Mehtas* are freelancers and may work for more than one transport agency. They are the ones who are in direct contact with the client and are responsible for connecting the consignment with a truck.

Seth (broker 2). *Seths* are middlemen between the *mehtas* and the drivers. They are usually veteran drivers who have extensive contacts with the drivers visiting the yard. The *mehta*, who is more towards the client side of things might not have the proper contacts with the drivers. Therefore, *seths* take over the responsibility of acting as a liaison. In most cases, a new driver who comes to the truck yard has to get in touch with the local *seth* to get introduced to *mehtas* for getting a consignment.

Drivers. Drivers are hired based on recommendations from acquaintances or other drivers and drive the same truck. They stay with the truck even when the truck is waiting at the truck yard. When on a trip, they tend to drive for long periods continuously, eating at roadside eateries and sleeping either inside or under their trucks.

They are given a certain amount of money for the trip from which they can draw for fuel, food, tolls, among other miscellaneous expenses [2]. They are required to maintain a logbook to keep track of expenses during the trip that will serve as documentation and be verified by the *mehta* as to what was done with the money that was given for the trip. While drivers working with corporate fleets who have fixed salaries earn between 12,000 to 17,000 INR (Indian Rupees), their counterparts driving individual trucks whose salaries are based on the economic functioning of the truck (often called “truck running” (sic)) in the sector, make about 7,000 to 10,000 INR a month.

Due to the spending long periods away from home, harsh working conditions, and lower social status, there are not many newcomers into the profession which has led to a shortage of drivers across the country. The government, in an attempt to tackle this issue, has lowered the educational requirement to get a driving license from Class 10 (high school) to Class 8 (middle school), which gives an insight into the low levels of educational qualifications of the drivers.

“overall 37.1% of truck drivers were educated up to primary level (until Class 5th), 44% were educated up to high school level (until Class 10th) while 8.8% were illiterate.” [2, p. 9].

Khalassi (Helpers/ Cleaners). *Khalassis* are assistants of drivers who are mostly youngsters. Their role is to help the driver with reversing, taking sharp turns, cleaning the windshield, and other supportive tasks. In many cases, these *khalassis* work as apprentice to the drivers and learn to drive and become future drivers. The shortage of drivers has also led to the role of helper becoming almost non-existent in recent times. The drivers also prefer it that way as they get some extra money for running without a helper.

5.3 Everyday challenges in trucking

Flow of information and money. Since *mehtas* are the people who deal with the client, as they are the ones who receive money for the shipment. After taking a cut from it, they hand it over to the *seths* who in turn take a cut for themselves before finally handing over the payment to the driver. This leads to an interesting scenario wherein at each level the person does not know how much money was actually received by the person at the higher level.

User interview 1: “After deducting the logistics company’s profit, the drivers would be eligible to get a sum of say 12000 per trip. The instruction first goes to Seth and Mehta. They could take 2000 each and tell us that the final amount is 8000. These kinds of cheatings happen all around the place. But nobody will know whether it has happened”

— Gopal (name changed), co-driver of a truck running within Mumbai suburban.

When the company is ready for a consignment, the intermediary *mehtas* and *seths* do not notify the driver about the financial side of things. A consignment might be worth 11000 rupees. But the *seths* and *mehtas* can easily grab a fair amount from this amount and tell the driver that the consignment's value is 8000 rupees. The important issue is that the drivers will never know if they are being cheated like this albeit being aware of such practices. In addition, bribery remains rampant in the sector and does not go in any official records. Drivers ultimately pay the bribe as there is no other way to escape from this. As this amount is unaccounted, drivers find it really difficult to convince the *Seths* about incidents as there is no proof. *Seths* argue that drivers could easily lie about an incident and snatch the amount. Further, *seths* claim that drivers steal goods and fuel and sell them to make extra cash. Nobody trusts anyone and that seems to be the core issue in the industry. Only a solution that ensures transparent data flow can solve this trust issue.

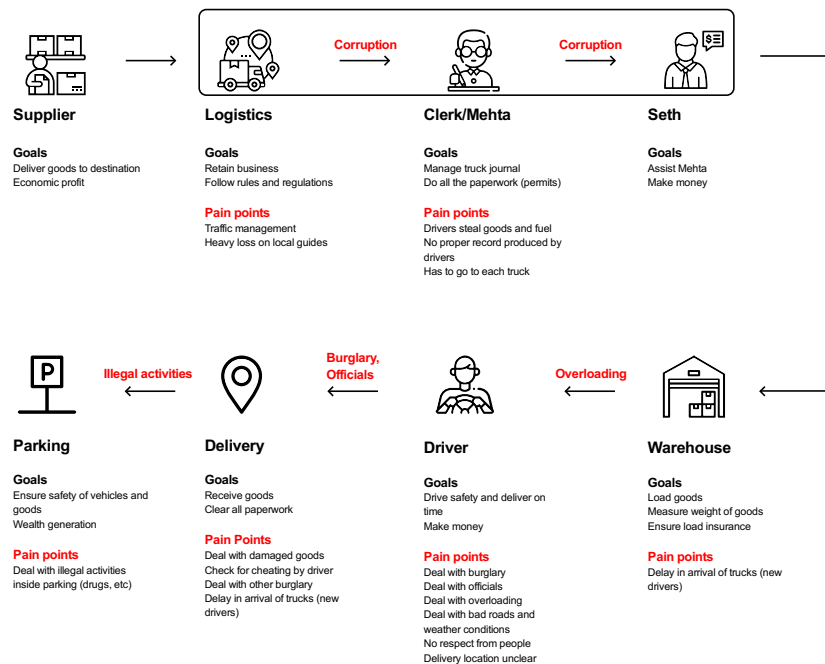


Fig. 2. Stakeholders and their challenges

Overloading of trucks. In a reciprocal manner, *mehtas* may collaborate with the client to overload a truck with more weight than what is mentioned on the bill. Trucks are not usually equipped with a gauge to measure the weight of cargo on the bed and thus drivers would not know whether the truck is overloaded or not. For example, a consignment might say that it is 15 tonnes on paper. But the company/ *mehtas* can take

advantage of drivers and load the truck up to 15.5-16 *tonnes*. This will effectively affect fuel consumption and drivers end up paying for the extra fuel. Most of the time drivers ignore this extra amount as it may not exceed INR 500 per trip; however, considering the fact that the company/ warehouse might be involved with a large number of trucks makes one imagine the economic benefit that is gained. The National Highway Authority of India (NHAI) is in the process of installing technology such as electronic weighing machines at various toll stations to curb this malpractice. However, this issue still persists for trucks that do not take a route with such a toll booth.



Fig. 3. A truck driver getting his papers cleared from Ashish Bhai. Ashish Bhai (yellow shirt, name changed), a *mehta* working for a transport company clearing the truck journal and passes for a truck. The driver was patiently waiting beside him and he was convincing Ashish Bhai that he lost some amount due to bribery. However, Ashish Bhai claims that the driver is to be blamed. Ashish Bhai works for 5 companies and he earns 5000INR per day. In a day, he clears a minimum of 3 trucks.”

Consignment allocation and lack of centralized information. The idea of a preferred consignment can be of two types – destination and the good carried. A destination preference might be due to the driver being from a particular part of the country and a trip to that part meaning that they will get to visit their family members. In terms of preference of good carried, some drivers might not be willing to take glass or other fragile items in small quantities as it does not allow them to load their truck with an additional consignment due to the nature of the good involved.

After having registered with a transport agency and waiting at the yard, the driver may face a possible challenge. For example, it is possible that some other transport company might have a more favorable consignment that is not in the driver’s

awareness. While it is possible that one truck can be registered at more than one agency, with the plethora of agencies present, it is simply impossible to have visibility into all of them resulting in a lapse of smooth functioning of the sector.

Further, it is possible that a driver could get a preferred consignment from another company but as he is not registered with them, he will not know about such a consignment; this challenge of communication is quite rampant in this sector. These situations result in financial loss in such a business where time is of utmost importance. This is an issue faced by drivers who own their own trucks. Such private trucks would be registered with only one or two transport companies and most of the time they would wait for 5-7 days for a consignment. Some of the drivers had waited for more than 10 days.

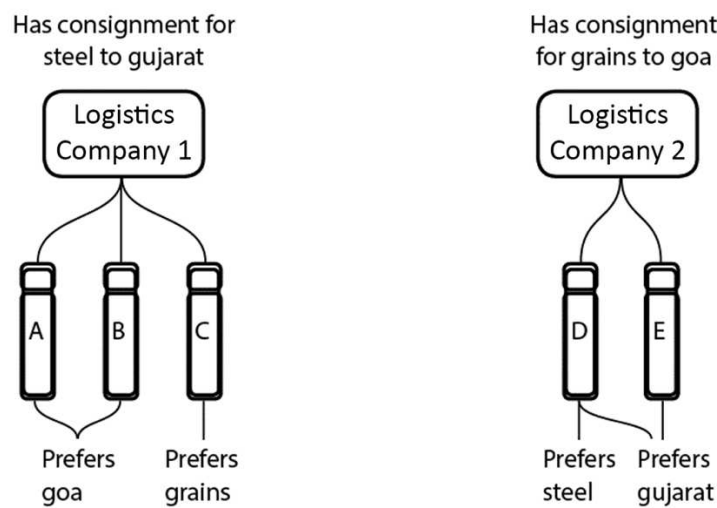


Fig. 4. Truck consignment problem

Further, when registered with a transport agency, drivers have no information on how many people have registered before or after them. This has given rise to practices like *mehtas* and *seths* favoring their more acquainted drivers by giving them consignments ahead of the queue. It is also due to this lack of accessible information and lack of coordination among the transport agencies that the freight rates haven't been able to keep in touch with the level of increase in trip expenses to the point that they are artificial and not a true reflection of a free-market [17,18]. This is because, currently, if an agency quotes higher prices, they will have difficulties in finding clients and hence the status quo remains unchallenged. These artificially low prices are often manifested in the form of lower income for those at the lower levels of the hierarchy or in the poor condition of the trucks.

“truck operators, whether large or small, are “price takers” in the industry. Due to tough competition and fragmentation, truck owners cannot dictate freight rates” [14, p.12].

5.4 Challenges on the road – Burglary and natural calamities

There are occasions when trucks are robbed when the area they have parked is not safe enough. There are also incidents where running trucks were looted by armed mercenaries and because of the advantage in numbers, they could easily get away. Drivers pray for their own lives, as they keep on driving the truck being looted. Drivers report having faced random burglary in remote and isolated roads. This usually happens in *ghats* (hill valleys), for example, in the Indian state of Madhya Pradesh and truckers are often advised to pass through such regions as a fleet of trucks. One of the drivers described a burglary that he faced. All he could do at that time was to keep on driving while thugs were stealing goods from a running truck. He was accompanied by his co-driver but they were heavily outnumbered by the thugs.

Along with burglary, natural calamities also wreak havoc on trucking routes, truckers had been stuck for 2-3 days on roads due to landslides which usually happen in the *ghats* of Southern India as well as mountainous regions of northern India. Drivers would be unaware of these natural calamities and without taking a bypass route they will head on to the affected region and get trapped.

6 Discussion: Avenues for sociotechnical digital transformation in the trucking sector and key insights

The past sections highlighted some basic challenges in terms of lack of transparency, power hierarchy, and flow of information. In this section, we present avenues of how digitalization can ameliorate some basic challenges in this sector.

Business generation. While the current system of registering with transport agencies has to live with the limitations of the reach of the agency, new-age services like *Black-Buck* (an uber-like platform for inter-city trucking), through digitization, are trying to expand the pool within which one can look for trucks and also making it possible to find loads for return trips as well. With this model where all demand is aggregated together, it is also possible to merge smaller consignments and present them as a single consignment to the trucker, eliminating the waiting time to achieve a full load. Apart from making it easier to find orders, such services also facilitate a dynamic pricing model based on the market [19]. This can help solve the issue of artificially low freight charges that are a byproduct of the decentralized brokerage system where the owners do not have much of a choice in negotiating prices. In addition, they facilitate the acquisition of payment or insurance digitally.

Key Insight 1. In the future of the digitalization, artificial low freight rates can be combatted effectively through transparent technology. This avenue requires a conjoined understanding (“joint optimization”) of socio-dynamics of business and technology.

Driver well-being. To help drivers from spending long periods away from home, tech startup *Rivigo* has introduced the concept of driver relay that creates a network of ‘pit stops’ across the country where drivers can be switched to ensure that they do not spend more than 5-6 hours straight behind the wheel and can return home within 24 hours [20]. This would also increase the attractiveness of the profession of driving. While this is primarily focused towards larger fleets, the pit stops thus created can serve as proper rest or refreshment spots for drivers where they can even sleep properly when the truck is parked safely without fear of burglary. The rise of digital payments can not only facilitate getting insurance or receiving payment digitally, it can also ensure that the people in the lower levels of the hierarchy get their fair share by eliminating the multiple levels payment has to pass through currently.

Key Insight 2. The future of digitalization can only be ensured in the trucking sector, if the social capital of the trucking sector is enhanced. This includes improvement in well-being by creation of infrastructure which specifically focuses on work-rest services that is linked to digital economics.

Fleet management. The arrival of GPS & smartphone-based tracking solutions has brought in a lot of visibility to make it possible for the owner as well as the end customer in terms of whether the shipment is on course for timely delivery. It also helps the owner keep a check on over speeding, unwanted stoppage, or deviation from the designated route. Further extending the use of GPS tracking, it would be possible to observe whether drivers are driving long hours at a stretch. If this data is made public, it can help law enforcement enforce regulations in this regard if necessary. Fuel cards (a kind of debit card for fueling alone) that have been introduced some years ago are becoming more commonplace and provide a fool-proof way to keep track of fuel expenses, which account for up to 25-30% of total trip expenses [21], as compared to manual logging.

It is even possible today to monitor for fuel theft by systems that continuously monitor fuel levels and check for anomalies on their own. Currently, firms like *Locus*, *FarEye* are working on generating optimized routes based on real-time traffic data that can ensure faster pass-through in times of traffic congestion, road construction, and even accidents or calamities, thereby saving time and fuel. Further, with the help of IoT sensors, it would be possible to ensure the quality and quantity of shipment intact. For example, a temperature sensor could monitor perishables, make auto-corrections [22] and trigger an alert when not possible. A weight sensor can ensure that it is brought to the notice of the driver and other stakeholders when contents are disturbed or removed, at unexpected times. Another possible area of intervention that can go along with route optimization is optimizing where and how much fuel is to be filled along the route as fuel prices can vary across states.

Key Insight 3. Transparency can be introduced in the system by digital services and monitoring of key parameters involved in the functioning of the trucks as well as fleets. In terms of the sociotechnical basis of driving, these include large-scale changes at regulatory levels of the trucking sector, considered as a sociotechnical system.

Infrastructure. In recent times, the introduction of digital services at the policy level such as *Fastag* (RFID based on-the-move toll transactions) and *e-way bill* (an electronic bill that can be directly verified online by police at check posts) have facilitated having lower stoppages before the trucks reach the destination [23]. This also reduces the avenues for harassment or bribery. The boom in e-commerce has already created an increased demand for trucking and warehousing. With large growth being predicted in the ready-to-cook, ready-to-eat space, the demand for cold storages and trucks capable of transporting them is predicted to increase as well. At present, the amount of fresh fruits and vegetables shipped via cold storage trucks is a meagre 4% as compared to 80-85% in the USA [21]. This presents a new space for the average owner who currently deals with only the ‘normal’ trucks.

Key Insight 4. The current changes in digitalization in India will bring about further changes in terms of purchasing power of technology for the small-scale truck owner, who currently focus on “normal” trucks. With the growth of digitalization newer form of technology-enhanced trucks will be available at the grasp of the truck-owner. In the long-run, this provides an understanding of adoption and diffusion of advanced technology in the trucking sector.

7 Conclusion

In this chapter, we have tried to understand the trucking sector in India as a sociotechnical system, by first addressing the current state with a bottom-up viewpoint. This was achieved through an ethnographic study that highlighted challenges related to the flow of information, lack of transparency, along with the social hierarchical setup of the sector. Based on these insights, we presented current and future avenues for digitalization in this sector.

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