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Improving efficiencies in logistics operations by converging tangible & intangible aspects

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A B S T R A C T

The principal objective of this paper is to conceptualize the scope of improving the responsiveness of logistics by eradicating the restrictions posed by unnecessary delays and human factors, in conjunction with underscoring the positive externalities that will emerge as societal benefits. Various attributes like 'idle time', 'geographical & regional aspects', 'truckers limitations', and 'uncertainties' have been taken into consideration to expand the outlook of logistics operations. This paper assembles knowledge to propose an approach to establish the convergence of various relevant aspects of the operational dimension of trade & transport facilitation. Furthermore, these are the aspects which although studied disjointedly were hitherto ignored as interrelated while planning logistics operations.

1. Introduction

A firm carries various value added activities for achieving a fixed objective, and this requires a high degree of coordination among purchasing, operations, and logistics functions for it to stay competitive. The logistics services provide critical support for facilitating various manufacturing process and ensures responsiveness by timely delivery of products at various customer locations (Fawcett and Fawcett, 1995).

In the ever evolving business environment of today, companies are exceedingly focusing on their core strengths and are outsourcing the logistics part; while demanding effective performance from the logistics service provider. Hence the logistics service providers have to continuously look for improvements in their propositions. The challenge is huge, as unlike improvements in the manufacturing processes the logistics operations are not entirely within the purview of a service

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provider. Much of the operational environment is dominated by the external factors like available road infrastructure, taxation & policy regimes, political aspects and many others. Therefore growth in logistics business needs focus on each option that holds a prospect for improvement, irrespective of how minuscule the evolution can be. Only important assessment criteria should be that the efforts must deliver sustainable results.

'Logistics operations' in the present context include transportation or delivery of goods outside the boundary of a manufacturing facility; and 'Efficiency' focuses on the reliability and effective utilization of logistics fleet. This paper proposes a solution to improve efficiency by removing delays at various junctures in logistics operations through the convergence of various tangible and intangible aspects. Where tangible and intangible aspects encompass, predictable delays (idling time, and waiting periods outside cities with entry restriction during daytime) and unpredictable delays (vehicle breakdown leading to interruption, congestions, accidents, and natural calamities) respectively.

Further, this paper brings forth such aspects that are not among the gamut of specialist measures (like information processing, distribution control, etc.), but are believed to be indispensable constraints. Therefore the issue that needs to be focused upon is how a logistics service can be structured around these constraints while aiming for competitive service propositions.

2. Literature review

The literature review shall point towards the following four significant issues in the concerned logistics operations:

i. Managing truckers for eliminating the delays introduced due to human factors

ii. Using regional/local intelligence as a harbinger for route adjustments

iii. Incorporating crisis/JIT maintenance to increase fleet availability

iv. Merging idle times with load-consolidation touch points to trim down delays

For effective evaluation and recruitment of truckers (or truck drivers), a comprehensive construct to understand over-the-road commercial motor vehicle operators' attitude towards safety regulations was formulated. It proved to be an effective approach for enforcing and regulating the traffic rules (Douglas and Swartz, 2009). The study clearly stated the risks and uncertainties that logistics operations face because of behavioural aspects of truckers. In another study dependency between truckers' health and safe driving practices was established (Olson et al., 2009). It underscored that working conditions having an impact on truckers' health also accentuates risks in logistics operations. But there exists a scope to further analyze the factors that influence truckers' attitude and on-road behaviour. This can help understand the intangible attributes contributing towards logistics risks and uncertainties, which eventually increases the delays introduced. Moreover effort can be done towards eliminating these attributes by planning logistics operations suitably.

Related studies focusing on deciphering the causes for delays have shown that between 40% and 60% of a driver's time in the work zone is not spent driving. This outcome has lead to monitoring of drivers' activities and performance to ensure the effectiveness (www.descartes.com). Such delays that get introduced on part of truckers' emphasize their response to the hostile work environment. Also, because of the work environment truckers' don't continue with a single organization for long. Furthermore, to reduce truckers' turnover rate in difficult work environments, three foci of commitment (to the organization, to the colleagues, and to the superior) have been considered in studies, as means to increase truckers' obligation towards their work and employer. The research has shown why managers need to work on increasing truckers' commitment towards the organization and consecutively improve truckers' retention (Paille et al., 2011). But the major point that comes to forth is that instead of working on top of creating an obligation in truckers' mind, efforts must focus on

improving their work conditions and social life. Because, a driver's working environment directly influence his/her level of job satisfaction and subsequent turnover.

Further, studies have focused on various tangible attributes leading towards the introduction of uncertainties, which finally increase the delays involved in transportation. 'Delay' is one among the various other causes that impedes the reliability of logistics operations. Delays get introduced because of reasons like congestions due to road work, peak traffic flow, and unplanned events like accidents. The consequence is the reduction in the efficiency of the logistics operations (Rodrigues et al., 2010). At the same time as, work zone delays are highly unpredictable due to dynamic factors influencing the flow of traffic. This affects the effectiveness and reliability of the logistics services. Changing traffic patterns and distractions often renders the operating environment confusing and frustrating. Consequently, it makes reviewing traffic delay estimation very critical for gauging the effect of changing conditions (Chien et al., 2002). The paper has rightly pointed out the need to consider factors which can increase the flexibility of the model it had proposed. Hence the preparation of an effective dynamic routing advice model not only requires the need for assembling the conditions that augment delays but also to understand the causes leading to them. This emphasizes the need for superior ways to comprehend a work region for continuously building relevant regional intelligence. As, it can be realized that most of these reasons are affixed to specific regions due to various factors which are only dominant, locally. Consequently understanding these factors and building upon real time local intelligence can be the way forward.

Also, logistics breakdowns lead to undesired increase in delays, and hence the maintenance facility constraint emerges as a major concern when the spatial coverage of operations is huge. So, the importance of maintenance plans becomes another critical aspect, and mainly when a logistics route is exposed to operating environments with marginal or non-existent infrastructure and the vehicle is under maintenance backlogs. Therefore, a workaround needs to be devised for overcoming these logistics risks and that too without introducing any further logistics delays. Indispensable restriction due to idle times adds up to transportation delays. What should be the response in operational terms when the foremost objective of the business is to aim customer satisfaction and delight? A.T. Kearney considers that focusing on total supply quality by achieving excellence in logistics operations is the correct approach.

For achieving logistics excellence the responsiveness of the system has to be improved. But there are multiple explanations both predictable and unpredictable which adds up to idle time. This eventually reduces availability of the fleet and shoots up costs involved. Various attributes contributing to the idle time and overall delay are:

i. Idling time of trucker

ii. Time lost in congestion

iii. Time wasted due to uncertainties and risks(vehicle breakdown, accidents, etc)

iv. Waiting periods at interstate and inter country borders

v. Waiting periods outside metropolis cities due to entry restrictions during daytime

As the average length of the logistics operations increases the inefficiencies leading to delays gets amplified and affects the delivery process (Naim et al., 2006). The delivery process also gets delayed if the fleet capacity is insufficient, which causes disruptions in the logistics operations (Fowkes et al., 2004). Uncertainties arising due to sovereign risks and regional instability also pose risks to the efficiency of the supply chain (Tummala & Schoenherr, 2011). All these factors can have an undesirable effect on the frequency and eventually on the distance covered.

Two areas need to be looked into during the logistics planning phase for eliminating the transportation delays. These are the night halts taken by truckers for sleep and the waiting periods outside the cities due to entry restrictions. Moreover these are the only areas which are under the control of the logistics service provider. So, the main questions that arise are:

i. How to eliminate halts taken by truckers for sleep and rest?

ii. How to exploit the waiting time due to entry restrictions into cities, in a productive manner?

This paper converges the human aspects (*like health, behaviour, and affects of seclusion*), maintenance issues, and reasons for delays (*like idling time for sleep, congestion, and waiting periods due to entry restrictions into certain areas during night*), and highlights how a new logistics structure can be designed around these factors to unlock efficiencies in logistics operations by reducing the intrinsic reasons for delays along with factors leading to risks and uncertainties. It also underscores the effectiveness of drivers familiar with the work zone in evaluating the circumstances for enhanced feedback leading to improved estimations.

3. Converging tangible and intangible aspects for optimizing logistics operations

The overall responsiveness and efficiency of the logistics operations is reduced by four main causes - delays, variable demand/poor information, delivery constraints, and a lack of coordination, which results in increasing the uncertainties in the logistics operations. Also, among the factors contributing to delays, the largest impact is made by the uncertainty due to road congestions. Further, congestion constitutes delay components due to road-repair work and peak traffic flow, which can be incorporated into logistics planning. But delay due to unplanned congestion (for example, due to an accident, lane blockage, and calamity) leads to greater disruption. So, to maintain the efficiency of the logistics operations, the challenge faced is to counter the effect of the delays introduced due to this unplanned congestion (Rodrigues et al., 2010). Out of the four causes identified earlier the focus of the present paper is to comprehensively analyze delays and the underlying uncertainties contributing towards it. As the earlier studies have also not categorised the factors contributing to delays into tangibles and intangibles, therefore the present paper will classify them explicitly under these categories.

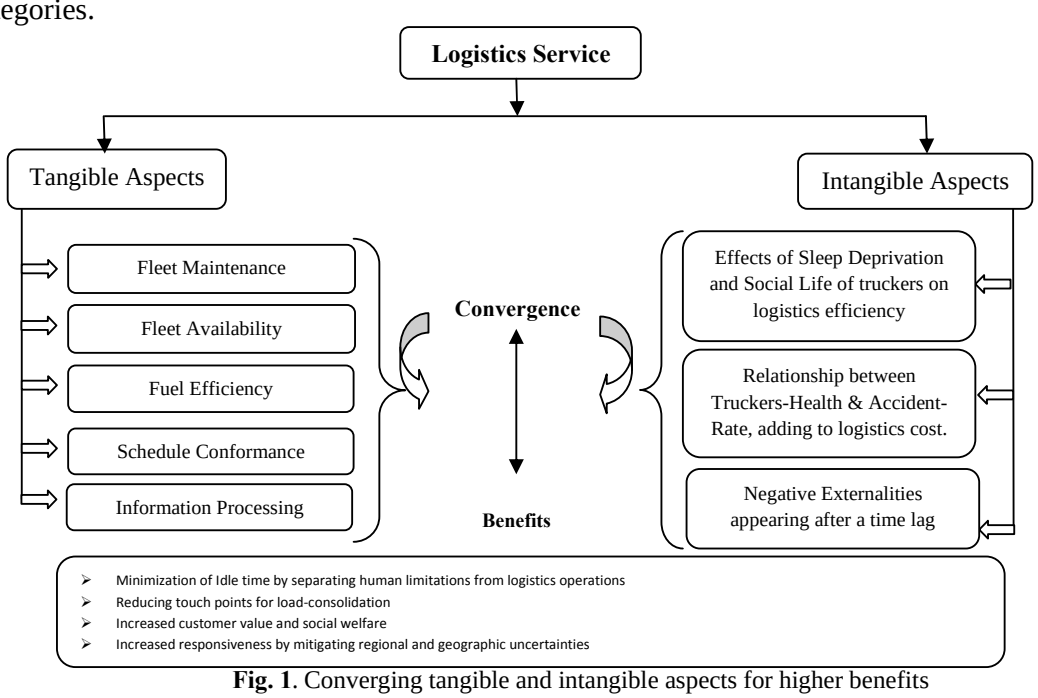

Fig. 1. Converging tangible and intangible aspects for higher benefits

Majority of the times the tangible aspects dominate the decision making for logistics planning. And, under tangibles aspects the predictive components guide to calculate definite time required for transportation and the unproductive components (like risks and uncertainties) are adjusted for as time allowances. The consolidated effect is used to reach lead times and overall planning in the supply chain. However, there exist various intangible aspects also, which indirectly result in tangible losses in terms of time and money. But they are never considered while planning because either their effects are not directly hampering the business or they show their weight with a time lag. Fig. 1 segregates various tangible and intangible aspects that influence the logistics operations and highlights the benefits that can be realised by considering them collectively for eliminating logistics inefficiencies.

The common challenges that emerge are the delays involved and uncertainties. Together these factors limit the efficiency and effectiveness of logistics operations. Various causes that contribute towards the challenges faced in the logistics operations are as explained below:

3.1 Miserable working conditions of the truckers and support workers

The logistics service providers' organizational characteristics, for instance firm size and carrier type influences driver attrition rate. Further a truckers' level of job satisfaction and willingness to continue with a firm in established by the working conditions to which he is subjected (Min & Emam, 2003).

Due to the high job expectations, truckers have to work for months at a stretch, leaving no time for visiting their home and time for rest in case of sickness. In some working patterns they get accustomed to living inside the trucks, preferably forgoing a traditional house. Long-haul truckers undergo behavioural changes, sleep and eating disorders due to spending appreciable time in regions where they face disconnect on multiple fronts. Idling restrictions and constraints in using facilities like diesel-fuelled auxiliary power system for air-conditioner/heater/other-equipment in sleeper-berth compartment further set hurdles and renders this work environment miserable. Living in seclusion with little time for family/friends and leisure makes them vulnerable. Further, the transport sector is especially vulnerable to HIV/AIDS. Transport workers including long distance truck drivers, seafarers, airline crews and infrastructure construction workers, often endure harsh working conditions, and may engage in unsafe behaviour that can lead to infection. Their mobility makes it difficult to access health information and treatment, or to maintain drug regimen. Furthermore, the sector works as a vector for HIV spread as the opening of new roads connects low and high prevalence areas. The limited evidence on the direct impact of HIV on transport's productivity shows that the disease can significantly compromise the effectiveness and reliability of the sector, with the capacity to further strain health systems and national economies (THE WORLD BANK, 2009).

These intangible aspects add up to social cost and indirectly to the performance of logistics operations. Driver's fatigue contributes to risk factor and adds to variable logistics cost due to accidents and delays.

The analysis of trucker's working environment highlights the following implications for logistics operations:

i. High driver turnover rate adding to manpower costs

ii. Lack of motivation to strive for efficiency and customer satisfaction

iii. Increase in the magnitude of risk due to accidents

iv. Increase in incidences of nonconformity due to casual attitude

v. Negative implications for society as a whole due to increased drug abuse and HIV/AIDS pandemic. This increases social cost and indirectly lumbers a nation's economy

3.2.Unavailability of regional intelligence and its impact on logistics planning

As shown in Fig. 2, there are different causes of congestion: “Recurring congestion”- which is the congestion caused by routine traffic movement in a typical work zone, and the “Non-recurring congestion”- Which is defined as unforeseen or atypical congestion caused by event that are not predictable and are transient. Non-recurring congestion can be caused by a variety of factors, including, but not limited to: lane blocking accidents and disabled vehicles, debris in the roadway, construction lane closures, significant roadside distractions that alter driver behaviour (e.g., roadside construction, electronic signs, and a fire beside the freeway), inclement weather. Further, even in places where congestion occurs routinely, the scope and intensity of congestion varies considerably from day to day (Hallenbeck et al., 2003).

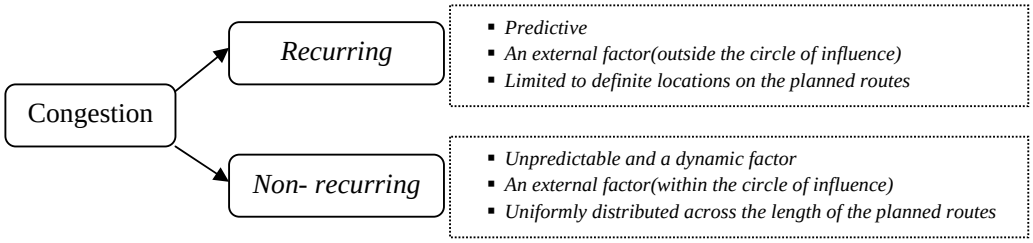

Fig. 2. Type of congestions

Drivers experiencing congestion are usually vulnerable to stress, which develops aggressive behaviour in them and further influence their reaction to the traffic (Hennessy and Wiesenthal, 1997). Further, micro level triggers on the route lead to congestion and hence regional factors affecting the time of travel need to be considered for planning. As these are ever changing attributes, so logistics planning also becomes a dynamically evolving concept (Managing urban traffic congestion, 2004). Also, possible interactions among various aspects of transportation, climate change, and regional hazards increase the sensitivity of logistics systems to regional factors (Mills & Andrey, 2002).

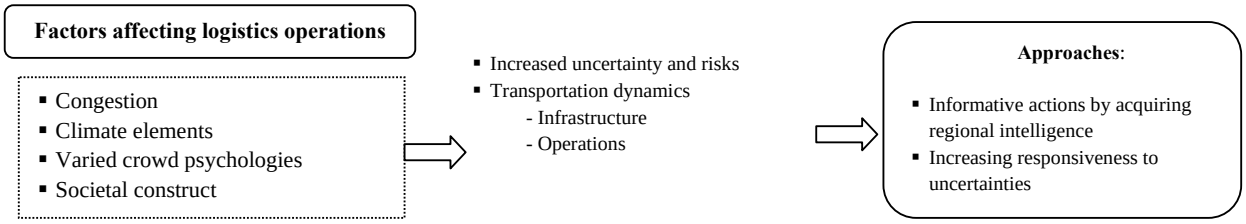

Fig. 3. Local/regional factors affecting logistics operations

Expected conditions change with location and time rendering congestion a dynamic variable, which effects the idle time of the fleet. The factor that holds potential to hamper the ‘regional logistics system’ or ‘logistics system exposed to varied regions’ need to be looked at. Thus understanding and working around the attributes, as classified in Fig. 3, will directly affect the operational efficiency of logistics system. This further implies that there is still, a significant room for improvement by leveraging on knowledge about factors like, time period and geographical scope, and utilizing the understanding of these factors during the formulation of effective incident response strategies.

Possessing capability to evaluate varied factors to which spatial network of logistics is exposed brings next level of improvement by ensuring reliability. Insights can be developed to build designs that evolve around regional factors through which the logistics has to traverse. The regional factors hold importance because:

i. They alter stress levels and road behaviour of the truckers and hence increase the risk factors.

ii. Certain features (like climatic conditions, regional dynamics) are very peculiar to specified regions and during an uncertainty regional intelligence proves handy.

3.3 Absence of breakdown maintenance adds up to logistics inefficiencies

Fleet maintenance involves keeping track of each vehicle's maintenance schedule. Fleet managers, who monitor vehicles for preventative maintenance, can save huge cost pileups by avoiding unnecessary repairs. Today the logistics maintenance systems are usually comprised of breakdown or preventive measures. Breakdowns result in unscheduled downtimes and waste of resources, because they miss the maximum utilization that can be achieved in case of preventive maintenance. A solution to avoid unscheduled downtimes while decreasing the waste of resources is to avoid the need for breakdown maintenance. Moreover, it is critical when there exist maintenance facility constraints and the spatial coverage of logistics operations is huge.

Mainly, the breakdowns in logistics lead to undesired increase in the delay. To avoid these uncertainties, due to untimely breakdowns preventive measures need to be taken while a vehicle is on the move. Hence, crisis and JIT repair/maintenance comes into picture. The importance for such maintenance plans become all the more critical when a logistics route is exposed to operating environments with marginal or non-existent infrastructure.

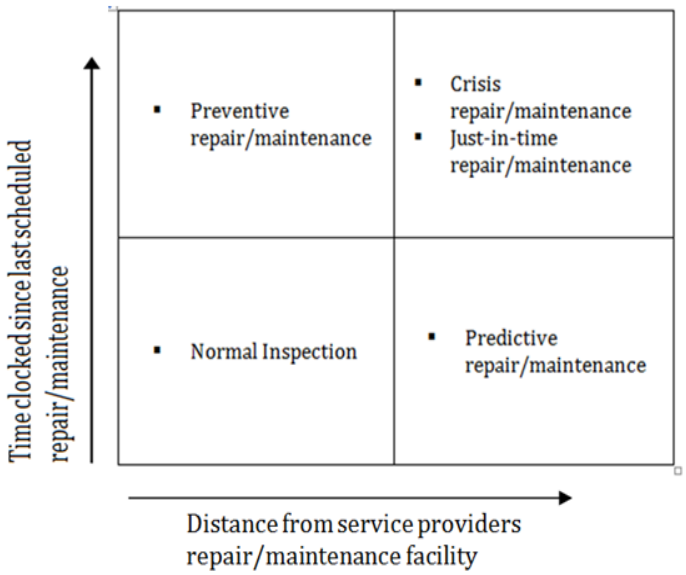

Fig. 4. Types of maintenances by way of their relation with 'time since last maintenance' and 'distance from maintenance facility'

Also, as categorised in Fig. 4, the need for emergency response model arises when the vehicle hauling the load is under maintenance backlogs or the distance of vehicle from the maintenance facility is huge.

***3.4** Increased transportation time due to more number of touch points*

The rapidity of the clearing and forwarding activities need to be improved to eliminate non productive delays. Such improvements become all the more essential when the consignment to be delivered contains perishable or critical items (Vijayvargiya & Dey, 2010). The benefits gained out of removing idle times are huge. Reliability and predictability increases, which is a very crucial element for perishable food items, and hence they can be delivered on time eliminating any food wastages.

In today's scenario load-consolidation in logistics operations is must for attaining efficiencies. But, increase in the number of touch points lengthens the cycle time. So, the main point of concern is – how to reduce increase in delays due to load consolidations, because there exists a trade-off between number of load-consolidation touch points and amount of delay introduced.

4. Proposed approach to overcome the limitations discussed above

Based on the limitations discussed before, this section proposes an integrated approach.

4.1. Managing truckers for eliminating the delays introduced due to human factors

A need emerges to innovate an approach that monitors the drivers and prevent them from increasing the detrimental delay. But, considering the type of working conditions and their psychological state enforcing more restrictions can only prove counterproductive. Hence the innovation need to incentivise them for meeting the targets and should motivate them to contribute towards achieving efficiencies in daily operations.

For working towards this direction, we must converge some other attributes that play spoilsport. To remove the biggest hurdle in logistics operations i.e. delay introduced due to resting periods of truckers, efforts need to be made in planning their operating hours in such a manner that the load under transportation is never brought to a halt. Because the vehicles' maintenance needs are catered to separately and hence should not stay idle during the resting period of the truckers hauling them. This can be achieved by removing the planning consideration that a single trucker will be assigned to a particular vehicle throughout the length of haul, till the delivery point. The distance to be covered by each trucker has to be fixed as per practical considerations of time involved, speed constraints, terrain, and also human limitations.

Trucker's work assignment has to be made in such a fashion that after a particular stretch is covered another trucker takes over the driving-activity and haul the load. Moreover if the truckers are appointed from the same regions that they are serving too, than they can return to their home, rest, and look after their family needs, etc. Major benefit that will emerge out of such an arrangement will be the boosted motivation levels and morale of the truckers. Additionally, because of enriched social life they will keenly adhere to the stipulated logistics schedule without a need for any insistence, and will have clarity about the performance expectations within the time framework allotted to them. These benefits will emerge and will be sustainable for the reason that truckers will have a reason to look up to, in terms of returning back to their personal lives after delivering their responsibilities. In conventional procedures truckers know that they have nothing else but to reach the destination, which is weeks or months away. So they cover distances casually managing distance travelled as per their discretion, by covering some stretches sluggishly and over speeding for the remaining, to make for the time lost. Such operating behaviours reduce the idyllic performance of the vehicle and importantly induce the risk components.

Planning their operation around a particular area (specifically their home regions) will involve multiple aspects of daily life, like work life balance by having frequent access to their home and social life. This type of system will acts as an incentive for them, motivating to perform and most importantly to stay with a particular employer. Definitely this approach asks for recruiting truckers from different regions and will involve costs and extra management efforts. But the major benefits that materialize are the elimination of delays due to resting periods and underperformance or casual operational behaviour. Moreover, managing truckers recruited over vast regions doesn't necessarily require brick and mortar presence at all the locations. Management can look into information and communication technology for cheaper management solutions specific to such workforce engagements.

Also, this design reduces the social cost by removing vulnerable behaviours like drug abuse and indulgence in unsafe sexual practices, which lead to road accidents and pandemics like transmission of HIV/AIDS. Hence social welfare and reduction in economic burden is another positive externality.

The approach discussed above is explained in Fig. 5, where the focus in on one of the possible routes i.e. *Route 1*(Route 2 being the other possibility). This particular route is comprised of multiple regions (depicted as regions 1, 2, and 3 respectively), where each region has some dissimilarities on account of terrain, congestion levels, waiting periods due to regulations, etc. Hence there exists asymmetry between the regions, and moreover the route 1 need not be a straight path. The regions are the work zones for each of the assigned trucker, which he/she has to serve during the allocated time shift. Delays, which materialize because of systemic reasons can't be eliminated, are taken into consideration while planning logistics operations in a region. A similar situation signifying the delay introduced because of waiting period (restriction for day time entry, or halt at interstate border check post, etc) is depicted by 'point A' for representation purpose only. The previous statement highlights another important aspect, i.e. existing state borders or political boundaries need not necessarily be the boundary for planning a logistics region. Further points 'B' and 'C' indicate the locations where second and third trucker respectively, will take the handover of load from the previous trucker. Also there can be planning situations where a particular driver catering to a specific region is forwarding the load for different trucks plying on different routes passing through that region. Such arrangements are the means to optimize the time utilization and productivity of each trucker assigned for a particular region. T1, T2, and T3, represent the duration of time shifts and all these shifts have same duration to maintain uniform working conditions for all the truckers. Furthermore particular situations may call for more than one trucker serving a particular region because of high number of routes crossing that region.

The main advantages realised out of the above approach are plenty. The main ones being:

i. Increased commitment levels and morale
ii. Reduced impact of human factor, hence reduced risks and uncertainties
iii. Improved/balanced social and work life of truckers
iv. Elimination of idling time, for reasons like - resting periods for sleep, on account of casual behaviour, and non compliance to performance standards
v. Reduced costs(both operational and social) and increased social welfare

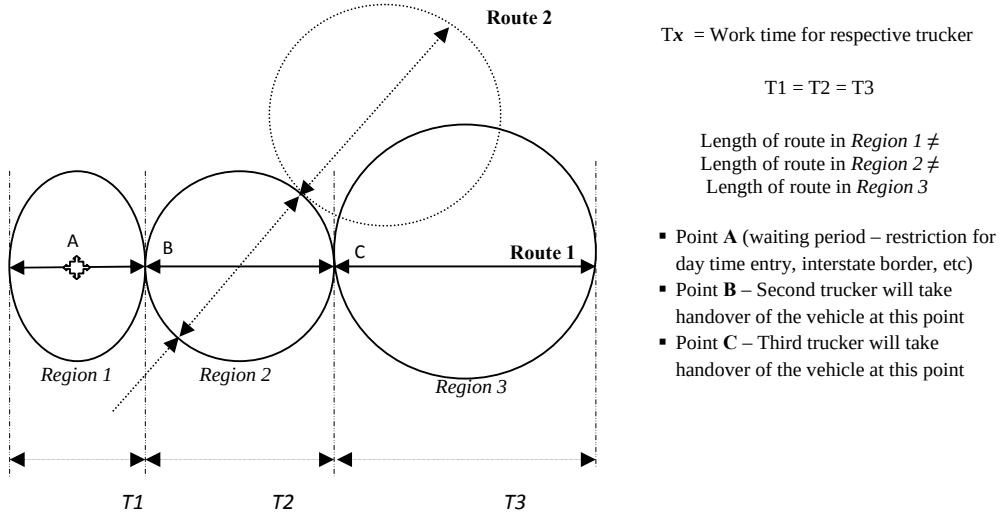

Fig. 5. *Assigning multiple truckers for a route along with relationship between load handover points and working time of individual trucker in respective regions*

Researchers have also compared drivers who have certain medical conditions with a control group in good health, so as to evaluate statistically the effect on the frequency and severity of trucking accidents. Evaluations were done to find costs associated and variations in the frequency and severity of accidents. The different econometric estimations produce findings showing that drivers having diabetes, coronary heart diseases, visual impairment, and high blood pressure have a significantly higher accident rate(or frequencies) than drivers in good health. Study had highlighted that although the age of the driver has no significant effect but the number of kilometres travelled increases the frequency of accidents, as does the number of hours behind the wheel. Such uncertainties lead to cost on account of: material damages (insured or not) and costs of physical injuries (private or public). Finally, the social costs incurred by these drivers are more than twice as high as those incurred by drivers in good health. Two questions remain to be clarified before penalizing all drivers with these two medical conditions: (1) Can precise measurement of the severity of these illnesses be used to distinguish the most dangerous cases from the others? (2) How can this information be used in effectively managing accident risks? (Dionne et al., 1998).

All the concerns raised here are catered to by the proposed approach. Moreover these are the positive externalities emerging out of this solution at no extra effort, and cost towards these concerns.

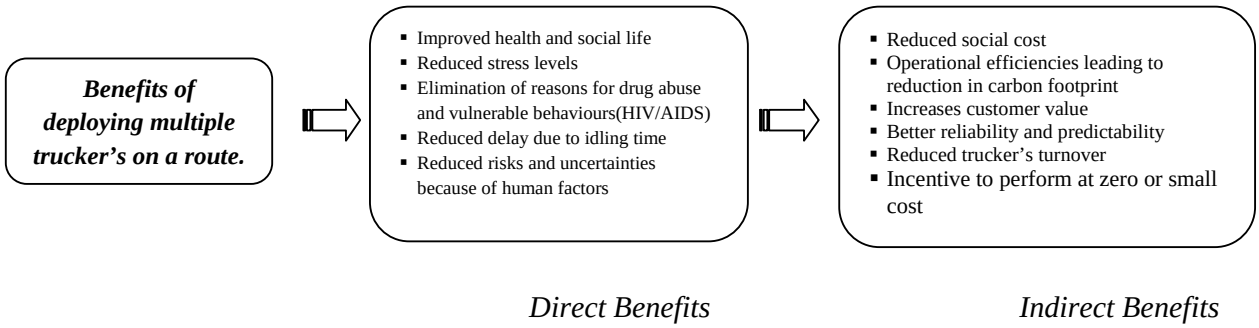

Fig. 6*. Benefits of deploying more than one trucker on a route*

As shown in Fig. 6, the proposed approach will lead to various direct and indirect benefits. The proposed approach eliminates the factors like increase in distance travelled and time spend behind the wheel. Moreover this solution helps in improving the health of the drivers and hence reducing the stress levels which contribute towards risk and uncertainties.

4.2.Using regional/local intelligence as a harbinger for route adjustments

Another advantage of regional deployment of truckers will enable the service provider to fetch local/regional intelligence, for which the best person is always the native who understands every aspect of that place. The key advantage is that the local person understands the social construct, can communicate effectively and decipher information correctly in local language while dealing with local elements, and is confident enough to improvise during unforeseen circumstances because he/she is adequately informed of the work environment. Such skills are advantageous and highly valued when the load under transportation involves hazardous materials.

Further, for consistently developing intelligence about the work zone, truckers are the appropriate people for gathering information. Also, this way truckers' will feel involved and empowered by providing specific insights that can help to make better plans. As, the working conditions in logistics are ever changing so the service provider need to keep sensing the developments that may either prove hindrance for business or may provide opportunities for further innovation.

Since even the thoroughly considered plans can flounder, contingencies must be established to expect the unexpected. The delivery organizations must have real time visibility into exceptions immediately when they occur, and for this the best source of information is again the person in the field. Also, a person new to a region may provide the details about a situation but may fail to figure out the probable causes. Moreover in circumstances where unforeseen route changes have to be taken because of local authorities, the person familiar to that particular region can act in the most appropriate manner. Such uncertainties are highly prevalent in developing countries where congestions and social disruptions are frequent. Furthermore sudden climatic situations affecting transportation and peculiar geographical terrains are best dealt with the person well-known to the local settings.

4.3.Incorporating crisis/JIT maintenance to increase fleet availability

To improve operational sustainment a decentralized approach must be taken. This system can greatly improve the efficiency and readiness rates. This may prove as an operational-to- strategic system improvement that can result in reduced cost and decreased vehicle downtime. During logistics operations just-in-time (JIT) and crisis maintenance is required. This need arises either due to emergency situation like accidents leading to breakdown (crisis maintenance) or due to fine-tuning required when vehicle propagates into a different operational environment (climate or geographical terrain requiring JIT maintenance like type pressure adjustments, fuel injection alterations, etc). Time required for such maintenances can be squeezed into the idle time during halts due to entry restrictions into cities during daytime, interstate border halts, etc. For such scenarios only specific and explicitly defined type of maintenances need to be permitted. This methodology will also require collaborating with repair/maintenance kiosks at specific locations.

This type of field maintenances approach will ensure to reduce carbon footprint of the logistics operations apart from other visible benefits like reduced wear and tear of tyres, increased mileage, and reduction in incidences leading to uncalled breakdowns.

4.4.Merging idle times with load-consolidation touch points to trim down delays

An important functional activity (load consolidation), which holds importance for optimization of logistics operations can be planned strategically to reduce delays. All the load consolidation points need to be planned during the indispensable halts that otherwise plainly adds to the delays. These halts can be ‘waiting periods due to entry restriction to cities’, ‘interstate border waits’, etc. In this way the otherwise unproductive time can turn out to be having additional relevance and will approach towards increased efficiency.

In today’s challenging business environment, advances in logistics planning that take into account various influencing aspects and try to mitigate them by innovative designing, leads to significant increase in value propositions.

5. Conclusion

Therefore if logistics planning takes into consideration various delays introduced because of human factors and eliminate them by innovating truckers operating schedules and by converging systemic constraint(like entry restrictions leading to delays) with other purposeful activities(like load consolidation), a huge benefit in terms of efficiency and service levels can be unlocked. Simultaneously innovative and informed maintenance schedule squeezed into logistics operations can help reduce various risks and regional uncertainties. Collectively the work environment of truckers and support workers can be improved, hence contributing to social welfare, reducing social cost, shrinking burden on economy, and directly eliminating risks that arise due to modified human behaviour.

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