The Role of Information Technology in Causing and Reducing Truck Driver Stress and its Relationship to Turnover

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Executive Summary

The trucking industry is one of the most vital in today's economy. A major concern in the industry is the high turnover rate of its key players- the truck drivers. Two reasons cited prominently in the literature for this high turnover rate are (1) the stressful nature of the job and (2) the old age (greater than 50 years) of a majority of the drivers, who will be seeking retirement in the near future. This study analyses three known aspects of the job that cause stress among drivers. These are work overload, characteristics of the physical environment they work in and the social interactions of the drivers with their supervisors, colleagues and others. In addition, we introduce an important additional potential stressor: the introduction of information technology into the Trucker work life.

Over the years, Information Technology (IT) has been infused into the Trucking industry in differing ways which has altered how truck drivers fulfill their job duties. This report provides trucking firms with a better understanding of the role of IT as both a stress inducer and as a job satisfier. It is hoped that the information provided here will begin to serve as a means to implement a more effective driver recruitment and retention strategy by examining sources of the driver shortage problem related to the use of Information Technology (Electronic Onboard Recording Device). The study focuses on stress causing and stress reducing aspects of information technology and how these aspects in turn relate to drivers' turnover intention. The two aspects of IT that induce stress include (1) IT monitoring the truck driver's driving behavior, and (2) the need to learn the IT. The three stress reducing aspects of the information technology investigated include: (1) informational support from IT, (2) communication support from IT, and (3) educational support from IT.

We introduce the "IT Stress: Inducer-Reducer model" to test the direct effects of IT monitoring stressor and IT learning stressor on driver's work exhaustion and to test the direct

effects of IT information support, IT communication support and IT educational support on driver's job satisfaction. Lastly, we examine the effects of these direct relationships on the driver's turnover intention. Key findings include:

1. **Stress from IT monitoring and the need to learn the new IT has a significant impact on drivers' work exhaustion**
2. **Drivers are more likely to quit when they experience work exhaustion due to being monitored by IT and having to learn new IT. Also as might be expected, truckers are more likely to quit when they are less satisfied with their job.**
3. **IT enabled Information Support and Communication Support results in increased driver's job satisfaction. This provides trucking companies with an opportunity to promote their IT investments in their efforts to retain and recruit drivers.**
4. **There are differences in how IT affects company drivers and independent owner operators. Companies should recognize these differences to ensure they are using and promoting IT in a way that best addresses their company drivers and owner operated drivers.**

Chapter 1: Introduction

A. Overview of the Trucking Industry

The trucking industry is one of the most important sectors of the transportation industry[1]. Almost every commodity that is transported through any other mode of transport is at some point transported through a truck. As such the trucking industry forms the core of the transportation industry. The trucking industry can be categorized in four ways (Burks, 2010)

1. For-Hire versus Private carrier: For-Hire carriers are companies that haul freight belonging to their customer while private carriers are companies that haul in-house freight as part of their supply chain distribution.
2. General versus Specialized freight type: This category classifies trucking firms depending on whether or not specialized trailers are required to haul freight. Generalized carriers use general commodity trailer while specialized carriers make use of special trailers that haul only certain kinds of freight e.g. refrigerated vans, car transporters etc.
3. Geographic Scope: This category classifies trucking firms based on whether or not the firms move freight confined within a metropolitan area or between cities.
4. Shipment Size: This category classifies transportation companies based on whether the average size of the shipment is big, medium or small. Small shipments are typical of

[1] Other sectors include Rail, Road, Air and Pipeline.

firms like UPS and FedEx that haul freight less than 150 pounds. Less-than-truckload (LTL) carriers haul of midsize shipments with an average weight of about 1000 pounds. Truckload (TL) carriers haul large amount of freight that range from 20,000-35,000 pounds.

The central players of the industry are the truck drivers. There are two types of drivers namely the Company operated drivers and the owner operator drivers. The company drivers are drivers who are employed by a trucking company and drive the company's truck. Owner operators own their own truck. They either contract with a trucking firm to haul freight for the company using their own truck or they own their own authority to haul freight. These drivers can choose to drive locally or haul freight over long distances usually going across states or countries. In the former case, the drivers are usually known as city drivers while in the latter case they are usually known as over-the-road drivers. The FMCSA regulates the hours of service (HOS) rule that allow the drivers to drive for 11 hours out of the total 14 hours they are allowed to work in a day. This includes driving, loading or unloading, fueling, inspections, dropping and hooking trailers etc. The drivers should have a mandatory 10 hour rest period after the 14th hour of service in a working day. The drivers are further limited to driving only 70 hours within an 8 day period. This is called the 70-hour rule. Recent advances in IT are purported to allow the driver to focus on driving while ensuring the regulations are met. One such technology is the Electronic Onboard Recording device which is the focus of this study and is a topic of the next chapter.

There is growing concern about the driver shortage in the U. S. trucking industry (The American Transportation Research Institute, 2011). Such concerns often stem from the increased

turnover which raises difficulty in recruiting and retaining qualified drivers (Min, 2002). According to the American Trucking Associations (Global Insight Inc., 2005), the turnover rate for truckload drivers is 75%. This rate is further expected to increase in the future since many of the drivers will be reaching their retirement age. This is a major issue for the trucking industry because it costs companies millions of dollars in labor replacement. The average replacement cost per driver is approximately $12,000 (Whitaker, 2010), but according to some estimates that cost could exceed $20,000 (Rodriguez et al, 2012).

To cope with this chronic problem, trucking firms have attempted to formulate various driver recruitment and retention strategies that include pay raises, bonuses, equipment improvement, and adjustments in working hours. Past research has consistently identified stress as one of the biggest factors affecting truck drivers' turnover[2]. Key stressors identified in past research include workload stressors, social stressors, and physical environmental stressors. Adding to these stressors is the pervasive introduction and infusion of IT (Information Technology) into the truckers' job as a new source of stress. As mentioned above, various technologies have been infused into the trucker's job both as a work tool and as a monitoring device. However, the stress occurring as a consequence of learning this new IT or in monitoring has not been studied.

[2] Other factors include: driver age, educational level, union status, prior driving experience, pay rate, amount of miles driven, home time, empty (dead haul) miles, job security, and job advancement opportunity.

While IT can be a stressor, others propose that IT can be a means to simplify, improve and enrich jobs by facilitating communication and coordination, by providing information for better decision making and by facilitating the proper use of the technology, thus reducing truckers' job stress (Huang et al.,2005). Although introduction of a new IT has the potential to be mentally fatiguing and frustrating, resources gained through technologies provide more useful information and social networking connection in the workplace are expected to reduce the employee's stress and enhance the positive emotions to IT.

B. Study Objective

After reviewing prior studies, it remains unclear how IT affects stress and turnover of drivers in the trucking industry. Therefore to better understand the effect of stress and turnover, it is important to study both the positive and negative stressing roles IT might play on work exhaustion, job satisfaction, and driver turnover. The main research questions to be addressed by this research are as follows:

1) What are the stress inducing and stress reducing roles that IT can play for trucker drivers?
2) How does IT affect truck drivers' work exhaustion, job satisfaction, and turnover intention?
    a. Does being monitored by IT and learning new IT lead to work exhaustion?
    b. Does IT improve job satisfaction?
    c. What effect does work exhaustion and job satisfaction have on turnover intention of drivers when IT is introduced into the job?

Chapter 2: Information Technology used in the Trucking Industry

Before we elaborate on the different kinds of information technologies (IT) used by the driver, a brief history of how IT's use evolved would help readers understand the need for IT in today's fast changing trucking industry with its demanding rules and stringent regulations.

A. Evolution of InformationTechnology in the Trucking Industry

Before the 1900s, the majority of the freight was transported through rail to central urban stations where the freight was unloaded from the train and loaded onto horse-drawn carts for distribution. In 1910, the gasoline powered internal combustion engine was invented which facilitated use of gear driven transmissions to transport freight. However the trucks could only be driven at a speed of about 15 mph due to the poor condition of the roads. During the period of 1914-1918, due to the increase in the amount of freight to be transported, railroads were becoming busy and congested. This encouraged more freight to be moved via trucks. During this period several advancements e.g. pneumatic tire cables, power assisted brakes and steering, and introduction of diesel engines were made to the truck that allowed it to move more load faster over longer distances. Truckers were asked to keep track of every hour everyday using paper logs. Originally they used pens and rulers to complete the paper logs. However this process was both tedious and time consuming. In 1950s, interstate highway systems were developed. Vehicle limits were put on trucks to preserve the highways for long periods of time. Intermodal shipping was also introduced to allow more efficient transfer of cargo between different modes of transportation. In 1970s, truckers used the CB Radio as their main form of communication with

fellow truck drivers. They used the CB radio to inform each other about police officers, road constructions and blockages, detours etc. Truckers also used the tachograph that recorded the trucks speed and whether the truck was stationary or moving. The truckers were asked to submit the graphs produced on a daily basis thereby accounting for how they spend time on the road. Both the CB radio and the tachograph were devices that were mounted on the dashboard in the cab. In 1980s, many trucking companies spawned due to deregulation of the trucking industry. Competition among them also increased. To gain competitive advantage, the focus of companies was no longer just on delivering goods from source to destination but the focus now was on delivering goods in a timely manner at a competitive price from source to destination. This necessitated improvements in many aspects of the trucking industry including driver performance, vehicle performance and compliance performance.

Information Technology was improved in parallel with the changing culture of the industry. By 1990s technological advancements made it affordable to install electronic onboard computers in trucks that would gather driver, vehicle and compliance data. The data was then downloaded from the onboard computers and uploaded on a personal computer to analyze. Because these onboard computers gave fleet managers access to real time data, they were better able to work with drivers to improve their driving behavior. Drivers found onboard computers useful since it eliminated the need to fill out paper logs which consumed their driving time and it turn the amount of money they make. In early 2000s, two main technologies: mobile communication technology e.g. cell phone and satellite based relays, and Wi-Fi helped improve customer satisfaction in the trucking industry. Global Positioning systems that used satellite

based relays helped track vehicle location which made routing and scheduling easier. Capability of messaging information on a real time basis to truck drivers also helped improve timely deliveries to customer e.g. dispatchers could alert drivers of last minute pick up changes. By 2010, continuing advances in business analytics helped fleet managers gain valuable business insights that are used to make faster decisions to capture target market thus providing a competitive advantage over competitors e.g. real-time location and delivery status notification through geographic mapping helped dispatchers pin point each truck's location and can track departures, stops, arrivals, on time deliveries and missed deliveries.

Table 1 elaborates on the different kinds of IT used in the trucking industry today. For our study purposes, we categorize this technology in two categories namely

a) Primary Technology: These are technologies that are used directly by the truck drivers in their daily activities to complete their job. Examples of such technologies include in-cab technology (e.g. Electronic Onboard Recording device (EOBR), CB Radio) and document imaging system that is used to scan and complete paperwork obtained after completing their daily tasks. In particular, this study focuses on the use of EOBR by truck drivers.

b) Secondary Technology: These are technologies that are not used directly by the drivers but have an effect on the way they complete their jobs. For example, fuel management systems that inform the supervisors of the driver’s fuel consumption patterns, and Load Scheduling system that are used by the dispatchers to assign the next load to appropriate drivers while driving. The table is not meant to provide a comprehensive list of all the technologies used

but instead is meant to give an example to the readers of the different kinds of IT that are commonly used by truck drivers in USA.

Table 1 Kinds of information technologies used by the truck drivers

Primary Technology	
CB Radio	Used mainly for communication among the drivers on the road about traffic congestion, accidents, bad weather or presence of an officer
Document Imaging Systems	Used by drivers to scan bill of lading and other documents. The system allows the drivers to complete their paper work faster.
Global Positioning Systems (GPS)	Assists drivers in trip planning, detours and rerouting, and other driving conditions. Some models offer turn-by-turn directions are available before the trip or during the trip via audio and video
Wireless Internet Connectivity	Provides drivers access to websites and personal email account
Text-to-Voice Messaging	System reads messages to drivers. Drivers are no longer required to pull over to read the messages
On-Demand In-cab training	Allows new recruits to view training modules in their cab without travelling back to the operation center
Electronic Onboard Recording Device	Automatically records driver's hours of service, alerts drivers when work hours have expired and monitors other driving behaviors e.g. Miles per gallon, speed, Idling time
Secondary Technology	
Load Scheduling Information Systems	Automatic assignment of load to an appropriate truck driver and relaying this information while the driver is driving
Strategic Information Systems	Customer friendly websites that enable customer transactions to be completely paperless
Pre-Clearance Information Systems	Drivers with a good driving record can bypass the weight stations and thus can avoid stress associated with waiting in a queue to be cleared
Fuel Management Systems	Used to measure and manage fuel consumption. When low, driver is automatically notified.

(Source: Internal Revenue Service U.S. Department of the Treasury, Trucking Industry Overview, on the Internet at http://www.irs.gov/businesses/article/0,,id=170621,00.html (visited May 01, 2012))

B. Electronic Onboard Recording Device (EOBR)

In January 2011, the Federal Motor Carrier Safety Administration (FMCSA) proposed a rule requiring all commercial vehicles to install EOBR. Although the intention was to increase safety and compliance of the drivers using EOBR, this rule was resisted by drivers, especially the independent owner operators because the technology monitored their driving behavior every second. Furthermore, FMCSA was unable to provide any statistical evidence for the proposed increase in safety. The rule is currently being revised and the final mandate has not been announced yet. Many of the bigger trucking firms have already installed EOBR in their fleet. Before the invention of the EOBR, the drivers used to record their hours using paper logs. Now, the EOBR not only records their driving hours but also monitors, among other parameters, their duty status, short idling time, long idling time, and miles per gallon, excess speed, and log in and log out time. As shown in Figure 1, some of the major manufacturers of EOBR include Qualcomm, PeopleNet, and XATA with Qualcomm as the market leader. Table 2 shows some of the common features that are offered on the EOBR for the drivers' use.

PeopleNet Driver Terminal	PeopleNet Blu2
	
Qualcomm	**XATA**
	

Figure 1 Examples of EOBR

Table 2 Common features of EOBR and their uses

Features	Use
Log in/Log out	This feature allows drivers to log in the EOBR when they start their work day and log out of EOBR at the end of their workday.
Review Driver Logs	This feature allows driver to open and review or present to an officer their daily log details.
Manually change Duty Status	This feature allows a driver to manually enter a duty status change.
Automatically change	This feature allows the driver to automatically switch their duty

duty status	status between On Duty and Driving Status.
Enter Remarks in Logs	This feature allows the driver to enter information or remarks that they want to appear in their logs
Email	This feature allows drivers to send email messages to others
Conduct Vehicle Inspection	This feature allows drivers to record the time of pre-, inter-, post- and Department of Transportation inspections.
DVIR (Driver Vehicle Inspection Record)	This feature allows the driver to select the kind of defect on the equipment operated.
Changing Shipping/ Trailer Information	This feature allows the driver to enter and update shipping or trailer information.
View Start/Stop time	This feature allows the drivers to view the time of each of their start and stop events.
View Messages	This feature allows the driver to send or receive messages to dispatchers or supervisors.
View Hours	This feature allows the drivers to view their available hours, total hours in each duty status for the current day, time on and off duty per regulation requirement
Remove Logs	This feature allows the drivers to remove their driver log from the vehicle
Forced Data Call	This feature allows the driver to reboot and refresh the computer for an update

C. How EOBR Works

Figure 2 describes how the EOBR is embedded in the daily operations of a driver and the trucking company.

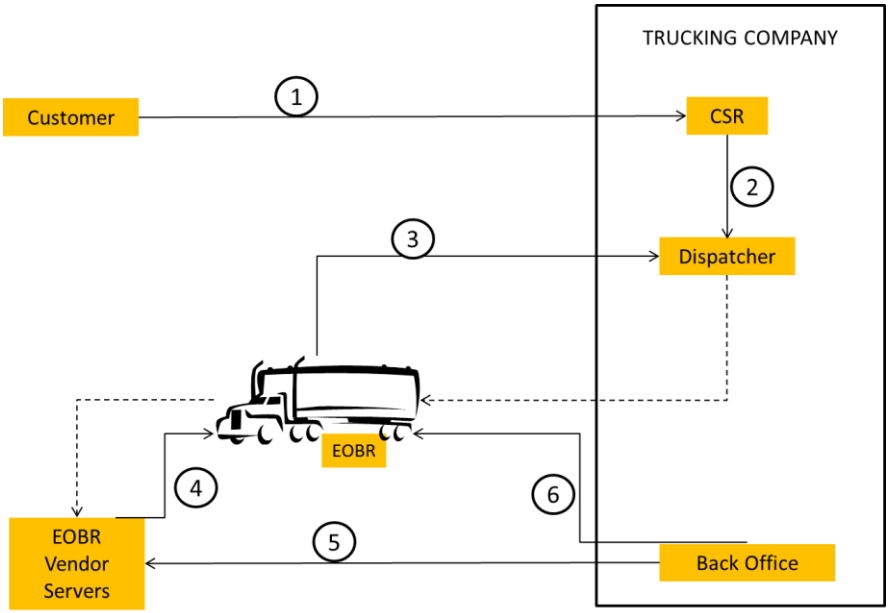

Figure 2 Flow Diagram of how EOBR is utilized daily

The customer first contacts the customer service representative (CSR) in the trucking company to place an order for load delivery or load pickup. The CSR takes the order and rearranges the information in a format suitable for the dispatcher's system. The dispatchers' computer terminal contains an EOBR application that allows them to communicate with the drivers. Using this application, the dispatchers relay necessary information to the driver about their next assignment e.g. Location of pickup/delivery, time of pickup/delivery, container number, chassis number etc.

Sometimes, a cellular phone may also be used for communication. The EOBR receives and stores this data. It then transmits location data and other messages over a secured network to the data center of the EOBR vendor. The data center processes the data and passes this

information to the trucking company's back office or to others across the supply chain as desired. Information can be viewed via the EOBR vendor's software interface or the trucking company's own back office software. While the back office in the trucking company keeps a record of all the communication taking place between the dispatcher and the driver, the EOBR vendor also records the data from the EOBR in their servers. In addition to the communication records, the EOBR also monitors and records certain parameters that relate to the driving behavior of the driver e.g. speed, idling time and miles per gallon, driver logs. Some of the data can be accessible to the driver too e.g. his driver logs. (This is represented by the dashed arrow going from the EOBR servers to the truck). The back office can then run analysis on the data to determine the driving behavior of the driver. Based on insights gained from such analyses, the trucking company may decide to train the driver or provide relevant feedback to improve their performance. Most EOBR vendors also have resources to run analytics on the data collected for the trucking companies. The decision of whether to perform analysis in house or purchase it as a service from the EOBR vendors largely depends upon the cost and the availability of the expertise and other resources needed to conduct the analyses.

Chapter 3: Effect of Information Technology (IT) on Truck Driver Turnover

A. Research Motivation

Past research has consistently identified stress as one of the biggest factors affecting truck drivers' turnover.[3] Truckers suffer from high stress and work exhaustion leading to turnover. Key stressors identified in past research include work overload, stress from social interactions with colleagues, supervisors and family members, and stress from the physical environment e.g. road constructions, bad weather, road blocks etc. Adding to these stressors is the pervasive introduction and infusion of technology into the truckers' job as a new source of stress. Various technologies have been infused into the trucker's job both as a work tool and as a monitoring device. However, the stress occurring as a consequence of learning this new technology or being monitored by the new technology has not been studied. Recent years have witnessed the appearance of several interesting studies on stress due to new information technologies (IT). Unlike yesteryears, technology today is deeply embedded in workers day-to-day activities and has ubiquitously invaded the work life of workers beyond that which has been traditionally studied (Tarafdar, Qiang, Ragu-Nathan, & Ragu-Nathan, 2007). The concept of technostress has established the importance of stress due to IT and has become a popular buzzword in stress and IS (Information Systems) literature. While IT can be a stressor, others

[3] Other factors include: driver age, educational level, union status, prior driving experience, pay rate, amount of miles driven, home time, empty (dead haul) miles, job security, and job advancement opportunity.

propose that IT can be a means to simplify, improve and enrich jobs by facilitating communication and coordination, by providing information for better decision making and by facilitating the proper use of the technology, thus reducing job stress (Tarafdar et al., 2007). Although introduction of a new technology is likely to be mentally fatiguing and frustrating, resources gained through technologies provide more useful information and social networking connection in the workplace are expected to reduce the employee's stress and enhance the positive emotions to technology. Therefore to understand the net IT effect on trucker stress, it is important to study both the positive and negative stressing roles IT might play on work exhaustion, job satisfaction, and turnover.

B. Theory: The Job Demands-Resources (JDR) model

The job demands-resources model, a widely used model in stress literature provides several risk factors associated with job stress. These factors can be classified in two categories: job demands and job resources (Arnold B. Bakker, van Veldhoven, & Xanthopoulou, 2010; Demerouti, Bakker, Nachreiner, & Schaufeli, 2001). Job demands refer to physical, psychological, social and organizational aspects of the job that require an effort by the employee, while job resources refer to the same aspects as demands, but are intended to facilitate the attainment of work goals, to stimulate personal growth or to reduce job demands (A. B. Bakker, Demerouti, & Verbeke, 2004). Consistent with the concept of job resources of this model, in IS literature, Beaudry and Pinsonneault (2010) suggest that organizational resources can reduce employees' negative emotions which evoke stress during the implementation and use of new IT. For example, in technostress literature, Ragu-Nathan et al. (2008) provide empirical evidence that organizational mechanisms such as literacy facilitation, technical support provision, and involvement

facilitation can reduce the effect of stress due to IT use. However, the IT- triggered job resources which can reduce employees' stress is often noted but rarely studied in the technostress literature. Although a new IT is likely to be mentally fatiguing and frustrating, resources gained through IT like social network in the workplace are expected to reduce employee's stress and enhance the positive emotions to IT (Sykes, Venkatesh, & Gosain, 2009).

In this study we will focus on the dual role of IT as a job demand and a job resource. While recent IS literature has spawned studies relating to the impact of technostress on individual performance, there are few studies that have regarded IT as a job resource. From our literature review, we propose three job resources related to IT: IT communication support, IT information support and IT Educational support. The JDR model posit that job resources increase an individual's motivation to devote him/herself to work which in turn increases work engagement and job satisfaction (Demerouti et al., 2001). Following this premise, IT may play motivational roles to drivers because they are functional in (1) achieving work goals through IT information support; (2) reducing job demands and the associated physiological and psychological costs through IT communication support; and (3) fostering personal learning of technology usage through IT educational support (A. B. Bakker et al., 2004; Schaufeli & Bakker, 2004). We therefore propose a research model which combines aspects of technology (IT Learning Stressor and IT Monitoring Stressor) that are related to stress-inducing mechanisms thus causing work exhaustion with aspects of technology (Information Support, Communication Support and Educational Support) that are related to stress-reducing mechanisms thus causing job satisfaction. We call this model as the IT Stress: Inducer-Reducer Model.

Figure 3 presents a model that captures the hypotheses relating to our major questions of this study.

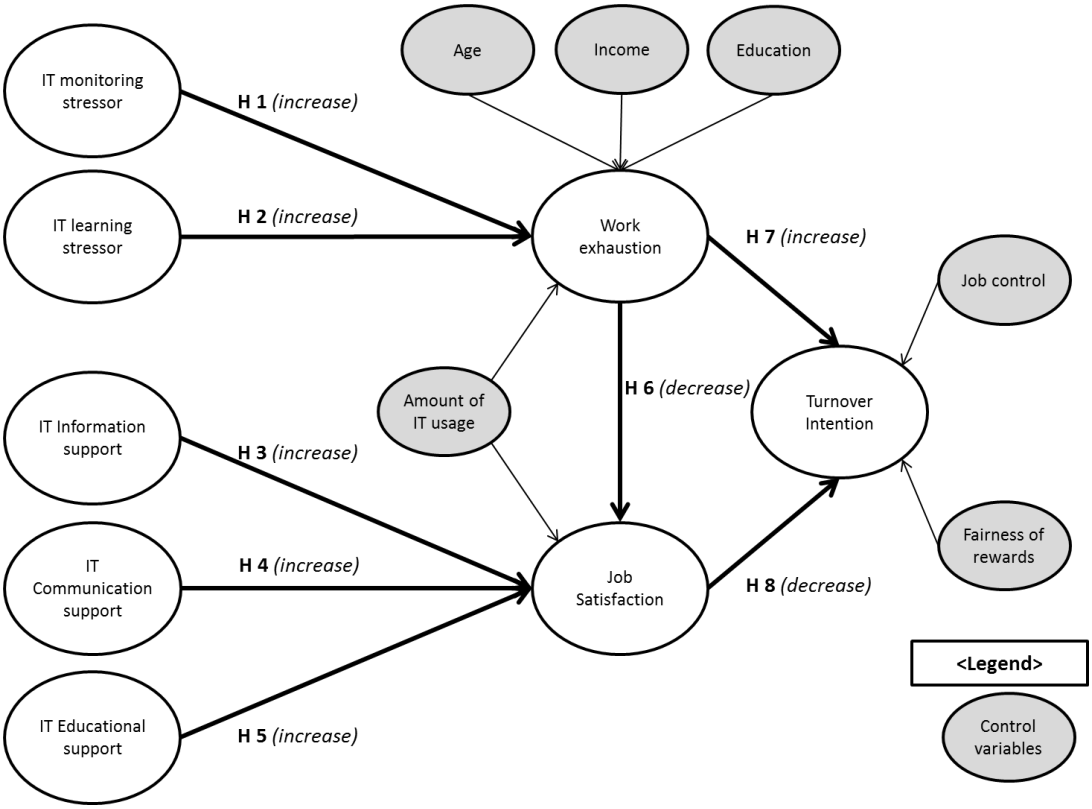

Figure 3 The IT Stress: Inducer - Reducer Model's Proposed Relationships

C. Stress Inducing Aspect of Technology: IT Monitoring Stressor and IT Learning Stressor

IT learning stressor refers to the stress induced by having to learn how to use a technology in the workplace. Many new technologies are a cause of frustration among drivers.

This is mostly seen with drivers above 50 years of age who are not well versed with using advanced technologies to perform their job duties effectively. Such stress results from those characteristics of IT that impede the driver's ability to work because of its complexity, hassle involved in its operation or its inability to generate information that is understandable (Ragu-Nathan et al, 2008). Ragu-Nathan et al (2008) also argued that such characteristics of technology may stress workers because they feel inadequate with regard to their computer skills and thus forces them to spend time and effort in learning and understanding technologies.

Advances in technology also allow for organizations to monitor the behavior and performance of the worker. However, research has often noted the stressful impacts of such technologies on worker. IT monitoring stressor refers to the stress experienced by individuals due to the obtrusive nature of technology. Such stress results from employees perceiving the technology to be invading their privacy or not giving them enough control over their job. Several studies have empirically proved that workers who are not monitored are less stressed and have low levels of anxiety, tension, depression and anger compared to workers who are monitored (Smith, Carayon, Sanders, Lim, & LeGrande, 1992). Furthermore, when employees are monitored on constant bases, this may induce fear or losing their job and over time such emotions can decrease a worker's motivation to do the job thus leading to work exhaustion. Electronic Onboard monitors that records the speed and the amount of time the truck was in motion can be seen stressful. For example, if the driver is carrying perishable goods or when the pressure to meet the delivery deadline is high. New geo-positioning applications may also add to

the potential for being monitored and thus causing a stressful impact on the driver. From the above arguments, we propose

Hypothesis 1: *IT monitoring stressor has a positive effect on work exhaustion*

Hypothesis 2: *IT learning stressor has a positive effect on work exhaustion*

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D. Stress Reducing Aspect of Technology: Information Support, Communication Support and Educational Support

IT Information support is the capability of IT to provide information required (1) to effectively complete the driver's job and (2) to make better choices and decisions. IT communication support can be defined as any aspect of IT that supports, enhances, or defines the capability of a worker to communicate and co-ordinate with others (Dennis, Wixom, & Vandenberg, 2001). Lastly, IT educational support refers to the technology's capability to guide users to use the technology in a way the designer intended to (Dennis et al., 2001). Although IT has been proposed as a stressor, some researchers have proposed IT to be a means to simplify, improve and enrich jobs by facilitating communication, collaboration and coordination, by providing information for better decision making and by facilitating the proper use of the technology (Kim & Lee, 2011; Ransbotham & Kane, 2011). Such kind of support leads to improvements in worker productivity as well as efficiency. Furthermore, the design of technology has also evolved to be more intuitive thus relieving the user with the cognitive load of understanding and using the technology. This helps workers accomplish their task faster and more efficiently thus leading to job satisfaction. Therefore, we propose

Hypothesis 3: *IT Information support has a positive effect on job satisfaction.*

Hypothesis 4: *IT Communication support has a positive effect on job satisfaction.*

Hypothesis 5: *IT Educational support has a positive effect on job satisfaction.*

Table 3 below provides a few examples of how IT can induce stress as well as how it can be a means to increasing job satisfaction for a truck driver.

Table 3 Examples of IT Stressors and IT Support for Truck Driver

Variable	Example
IT Monitoring Stressor	• Electronic Onboard monitors that record the speed and the amount of time the truck was in motion can be stressful. For example, if the driver is carrying perishable goods or when the pressure to meet the delivery deadline is high. New geo-positioning applications may further add to the stress.
IT Learning Stressor	• Many drivers find it difficult to view their driver logs online. This is mostly seen with drivers above 50 years of age who are not well versed with using technologies
IT Information Support	• Drivers use the GPS to show them the shortest route or to guide them in unknown areas. • Using a Prepass clearance system to relieve stress associated with waiting in queue at a weigh station • Fuel indicators or tire pressure indicators allow for planning on where to stop next
IT Communication Support	• Use of satellite communication allows for more coordination between the dispatcher and the driver. It also allows for delivery of emails through which drivers can stay in touch with their families.
IT Educational Support	• EOBR has colorful and interactive interfaces or features that help drivers navigate the system with less cognitive effort.

E. Causes of Turnover Intention

Lastly, this study looks at the effect of work exhaustion resulting from learning and being monitored by IT, and job satisfaction resulting from informational, communication and educational support from IT on a driver's turnover intention. Turnover intention is defined as a voluntary intention of employees to quit their organizations (Ahuja et al., 2007; Knudsen et al., 2009; Moore, 2000). Majority of studies investigating the influence of work exhaustion on turnover have demonstrated that employees with high level of work exhaustion are more likely to voluntarily quit from their jobs than employees with lower levels of work exhaustion. Past literature has consistently identified the relationship between employee turnover and job satisfaction to be negative. (Jason Bennett, Stepina, & Boyle, 2002; Mobley, Griffeth, Hand, & Meglino, 1979). While high job satisfaction leads to increased productivity, lower absenteeism, and lower employee turnover (Mobley et al., 1979), high levels of work exhaustion may reduce employees' organizational commitment (Ahuja et al., 2007) thus reducing their job satisfaction. We therefore propose

Hypothesis 6: *Work exhaustion is positively related to turnover intention.*

Hypothesis 7: *Job satisfaction is negatively related to turnover intention.*

Hypothesis 8: *Work exhaustion is negatively related to job satisfaction.*

To minimize omitted variable bias, we include age of the driver, annual income of the driver, education, job control, fairness of rewards and IT usage as control variables to control for the effects of external factors while testing for the main effect of IT stressors and IT support. Job control negatively

influences turnover intention, the assumption being that high job autonomy would lead to better performance, intrinsic motivation to learn, and help employees cope with the strain effects such as turnover intention (Karasek and Theorell, 1990). Fairness of rewards is the degree to which a driver perceives he is fairly and reciprocally receiving benefits from his firm.

Chapter 4: Research Method

A. Research design

Our research design used a mixed data collection approach. We collected both qualitative and quantitative data. In the initial study phase, we acquired requisite qualitative data by conducting field interviews. The data was then used to develop and validate the initial survey instrument. Using this instrument a pilot test was first conducted for increasing the instrument validity and internal consistency of the variables. This process helped us in building a final refined survey instrument which was then used for the field survey. Lastly, in the quantitative study phase, the data gained from field survey was analyzed using several statistical techniques. A summary of the steps is shown in Figure 4 below.

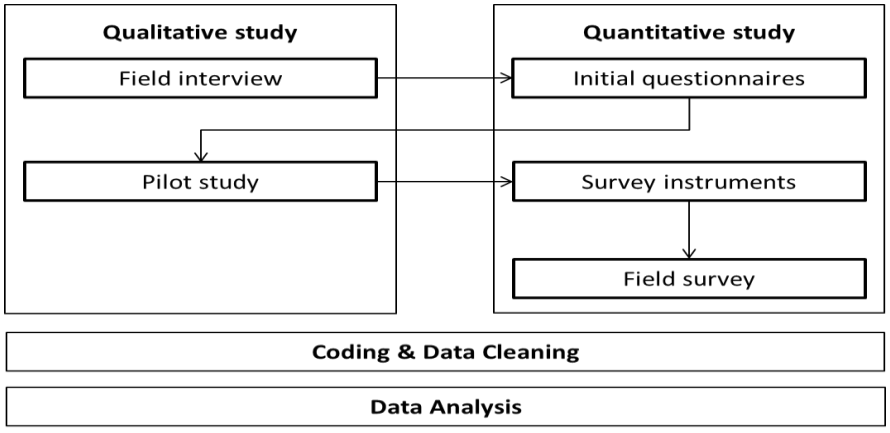

Figure 4 Research design

B. Survey Development

This study adapted most of the survey items from existing scales in the literature. Table 4 below summarizes the definitions of the variable used in this study.

Table 4 Definitions of Research Variables

Variable	Definition
IT Learning stressor	The extent to which technology is perceived to be stressful due to its complexity to the need to constantly learn new IT skills in order to efficiently operate it.
IT Monitoring stressor	The extent to which technology invades worker's privacy and is perceived as a way for organization to control worker's activities.
IT Communication Support	The extent to which technology helps in facilitating communication and coordination in the worker's social environment.
IT Information Support	The extent to which technology provides information to workers for better decision making and reducing uncertainty.
IT Educational Support	The extent to which technology helps the workers use the technology the way the designer had intended to.
Work Exhaustion	The extent to which a driver feels fatigue and worn out at work place
Job Satisfaction	The extent to which a driver is contented with the job he is engaged in.
Turnover Intention	The extent to which a driver is likely to voluntarily quit his job.
Job Control	The extent to which a driver perceives that he has the discretion and independence to do his job.
Fairness of Rewards	The extent to which the driver perceives his treatment by others at work to be impartial.

(Note: IT Learning stressor, IT Monitoring stressor, Information support, Communication Support, Educational support, Fairness of rewards, Job control, and Job satisfaction are measured using a likert scale ranging from *1=Strongly Disagree* to *7=Strongly Agree*. Work Exhaustion was measured using a scale ranging from *1=Never* to *7=Daily*. Turnover Intention is measured on a likert scale ranging from 1=Very unlikely to 7=Very Likely)

C. Data Collection

Our sample was obtained from truck drivers working for a large intermodal company (over 1200 employees, 700 truck drivers, 125 maintenance and repair vehicles and more than 5000 containers and chassis in container depots) headquartered in Mid-South US. In particular, we engaged one division that operated in three locations in the Southern US. The division employs two types of driver namely company drivers (also known as city drivers) and independent owner operator drivers (also known as over-the-road drivers).

Initial field interviews: We first interviewed one manager, one supervisor and four dispatchers. The interviews helped us get an understanding of operation of the company, of the daily job duties of truck drivers and how dispatchers assign tasks to drivers. We were also showed the technology operated by truck drivers to complete their daily tasks. This included scanning stations that are used by the drivers to scan and submit bill of lading and other document to dispatchers, and a training model of the EOBR used by the company to train drivers in its use at the time of hire. We also solicited expertise of a truck driver who gave us a deeper understanding of how truck drivers in general use the EOBR to perform their daily job duties.

Survey development: Using information from the interviews together with information from past literature, we developed a survey instrument. A pilot test was then conducted with 26 drivers for increasing the instrument validity and internal consistency. After completing the survey, participants were asked to provide feedback on the clarity of questions, response options, and the length of time it took them to complete the survey. The test responses of the survey were then reviewed to look for any inconsistencies or unexpected answers. All necessary changes

were made to the survey before implementing it on a larger study sample. This process helped us in building a final refined survey instrument which was used for the main survey.

Main Survey: The main survey was then translated into Spanish to cater for the Spanish speaking drivers. The expertise of a Spanish instructor at the University of Memphis and a native Spanish speaking IT vice president was solicited to create the Spanish survey. The survey was prepared using software called Qualtrics. The final survey can be found in the Appendix A. The survey was then installed on the driver scanning stations of all the three divisions. The driver scanning stations are computer terminals that are connected to scanners that are used by the drivers to scan and submit their daily paper work. Each driver was given $15 Wal-Mart gift card to complete the survey. The survey was open for three weeks at each of the location. A total of 190 truck drivers completed the survey. The day before the start day of the survey, flyers were hung on the hallway and the drive scanning station terminals to advertise the survey. The flyer can be found in Appendix B. Help from dispatchers was also used in requesting the drivers to complete the survey. One researcher in this study visited each location to train the supervisors and dispatchers in handing out gift cards and to ensure that they had appropriate knowledge of the survey in case technical issues arise. At the end of the three week period, the survey was deactivated from the driver scanning stations and the data was collected to be analyzed using statistical techniques. In total, we obtained 190 responses from all the three divisions which represented a response rate of 27.14%. This data was then screened for outliers, partial responses, random or inattentive responses which could have introduced noise in the data. This

was a necessary step in order to obtain a true effect size of the relationships hypothesized. The final sample consisted of 140 usable data points.

Chapter 5: Data Analysis

A. Descriptive data analysis for EOBR usage

Apart from collecting data on the research variables used in our study, we also collected data pertaining to the actual usage of the features provided by the EOBR. The drivers were asked to indicate the extent to which they used each of the features of the EOBR.

Table 5 summarize the drivers' EOBR usage pattern. The responses of CD showed the pattern of EOBR usage that differs from ID. These differences are motivated primarily due to the difference of truck ownership. From Table 5, we can see that majority of the drivers' use all the features of the EOBR daily except for "Conduct Vehicle Inspection" that is being used few times a Week. This suggests that all drivers have routinized themselves to using In-cab IT and are still using it extensively during their work. However, some features such as "Manually change Duty Status" (Company drivers: 23%, Independent Drivers: 14%), "Email" (Company Drivers: 13%, Independent Drivers: 17%), and "Remove Logs" (Company Drivers: 17%, Independent Drivers: 21%)" are not being used by a high percentage of the drivers. These unusual high percentage is probably due to the fact that several drivers lack knowledge about how to use the features to obtain useful information from them.

Table 5 Descriptive statistics of EOBR usage for company drivers and independent owner operated drivers

	Features	Ratio						
		1	2	3	4	5	6	7
Company drivers	Log in/Log out	0%	0%	2%	0%	0%	92%	6%
	Review Driver Logs	2%	6%	13%	0%	23%	50%	6%
	Manually change Duty Status	23%	11%	14%	2%	6%	33%	11%
	Automatically change duty status	6%	3%	11%	2%	3%	39%	36%
	Enter Remarks in Logs	8%	17%	19%	2%	9%	39%	6%
	Email	13%	9%	16%	2%	3%	28%	30%
	Conduct Vehicle Inspection	2%	2%	2%	0%	84%	11%	0%
	DVIR (Driver Vehicle Inspection Record)	2%	3%	9%	2%	8%	63%	14%
	Changing Shipping/ Trailer Information	9%	13%	9%	0%	0%	44%	25%
	View Start/Stop time	6%	14%	20%	0%	5%	45%	9%
	View Messages	0%	2%	3%	0%	0%	61%	34%
	View Hours	2%	0%	28%	0%	6%	52%	13%
	Remove Logs	17%	3%	2%	8%	3%	66%	2%
Owner-operated drivers	Log in/Log out	3%	3%	5%	0%	4%	79%	7%
	Review Driver Logs	8%	5%	18%	0%	14%	46%	8%
	Manually change Duty Status	14%	11%	20%	0%	8%	34%	13%
	Automatically change duty status	1%	7%	9%	0%	3%	54%	26%
	Enter Remarks in Logs	11%	11%	26%	1%	5%	34%	12%
	Email	17%	1%	9%	3%	1%	45%	24%
	Conduct Vehicle Inspection	4%	0%	7%	0%	3%	67%	20%

	DVIR (Driver Vehicle Inspection Record)	4%	9%	16%	1%	3%	51%	16%
	Changing Shipping/ Trailer Information	5%	8%	5%	0%	4%	53%	25%
	View Start/Stop time	5%	9%	12%	1%	1%	58%	13%
	View Messages	0%	4%	8%	1%	0%	54%	33%
	View Hours	3%	8%	16%	0%	9%	49%	16%
	Remove Logs	21%	9%	8%	9%	7%	43%	3%

(Note: 1=Never, 2=Rarely, 3=Sometimes, 4=Few times a Month, 5=Few times a Week, 6= Daily, 7=Many times a day)

In addition to analyzing the percentage of company drivers and independent owner operated drivers using each feature of the EOBR, we also ranked each feature by the extent to which each type of driver used that particular feature. To do this, we summed percentage frequency ratio for all the features that were used at least daily. The feature ranking for each type of driver is listed in table 6. We found that the drivers used the EOBR most to view messages received by dispatchers about their current or next task. Figure 5 shows a sharp contrast between CD and ID EOBR usage. We plotted a linear trend line with the rank of EOBR features in terms of CD and compared them with the ranked features for ID. The numerical score in Figure 5 is the rank of EOBR features for ID.

From table 6 and figure 5, we can see that there are some differences in In-cab IT usage between CD and ID. Conduct Vehicle Inspection" was ranked lowest by CD, but it was ranked second by ID. This is because independent owner operated drivers own their truck and thus more likely to be concerned about the condition of their truck compared to company drivers who are less caring of the trucks that the company owns.

Table 6 Ranking of the features of EOBR for company drivers and independent owner operated drivers

	Features	Ratio			Rank
		Daily	Many times a day	Sum	
Company drivers	Log in/Log out	92%	6%	98%	1
	View Messages	61%	34%	95%	2
	DVIR	63%	14%	77%	3
	Automatically change duty status	39%	36%	75%	4
	Changing Shipping/Trailer Information	44%	25%	69%	5
	Remove Logs	66%	2%	68%	6
	View Hours	52%	13%	65%	7
	Email	28%	30%	58%	8
	Review Driver Logs	50%	6%	56%	9
	View Start/Stop time	45%	9%	54%	10
	Enter Remarks in Logs	39%	6%	45%	11
	Manually change Duty Status	33%	11%	44%	12
	Conduct Vehicle Inspection	11%	0%	11%	13
Owner-operated drivers	View Messages	54%	33%	87%	1
	Conduct Vehicle Inspection	67%	20%	87%	2
	Log in/Log out	79%	7%	86%	3
	Automatically change duty status	54%	26%	80%	4
	Changing Shipping/Trailer Information	53%	25%	78%	5
	View Start/Stop time	58%	13%	71%	6
	Email	45%	24%	69%	7
	DVIR	51%	16%	67%	8
	View Hours	49%	16%	65%	9
	Review Driver Logs	46%	8%	54%	10
	Manually change Duty Status	34%	13%	47%	11
	Enter Remarks in Logs	34%	12%	46%	12
	Remove Logs	43%	3%	46%	13

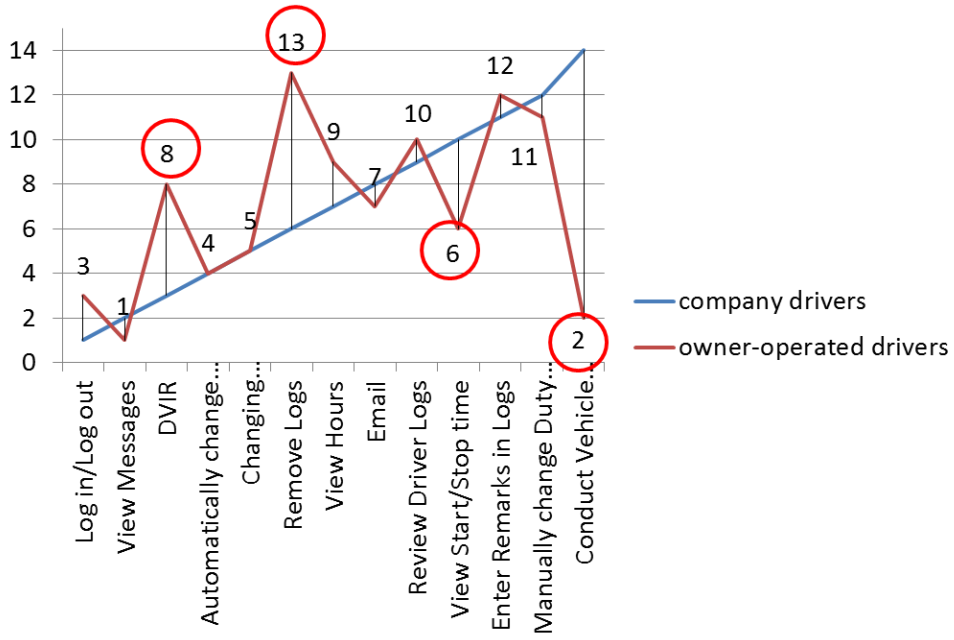

Figure 5 Comparison of the rank of the frequency of EOBR usage between Company Drivers and Independent Owner Operated Drivers

(Note: The numerical score in this figure represents the rank of the frequency of EOBR usage with owner-operated drivers.)

B. Descriptive data analysis of demographics and previously studied stressors

To analyze company drivers (CD) and independent owner operated drivers (ID) separately, we first divided the final sample of 140 data points into two groups. The data consisted of 64 (45.7%) company drivers and 76 (54.3%) owner operator drivers. Out of the total 140 data points, 138 were males while only 2 were females. This is not uncommon among the truck drivers since the trucking industry is majorly dominated by male drivers. Table 7 below summarizes the demographic variables in each group as well as other variables that have already

been studied in past literature such as work overload, physical environment stressors, social stressors, fairness of reward, job control and financial stressor.

Table 7 Descriptive statistics of demographics and previously studied stressors

Variable	Categories	Company driver		Owner-operated driver		All drivers	
		Count	**Ratio**	**Count**	**Ratio**	**Count**	**Ratio**
Age	25 to 34	11	17.19%	11	14.47 %	22	31.66%
	35 to 44	21	32.81%	27	35.53 %	48	68.34%
	45 to 54	22	34.38%	24	31.58 %	46	65.95%
	55 to 64	10	15.63%	11	14.47 %	21	30.10%
	65 or over	0	0.00%	3	3.95%	3	3.95%
Income	Less than $20,000	4	6.25%	5	6.58%	9	12.83%
	$20,000 - $29,999	10	15.63%	5	6.58%	15	22.20%
	$30,000 - $39,999	28	43.75%	6	7.89%	34	51.64%
	$40,000 - $49,999	14	21.88%	8	10.53 %	22	32.40%
	$50,000 - $59,999	7	10.94%	8	10.53 %	15	21.46%
	$60,000 or over	1	1.56%	44	57.89 %	45	59.46%
Education	Less than High School	3	4.69%	7	9.21%	10	13.90%
	High School Degree / GED	27	42.19%	36	47.37 %	63	89.56%

	Less than 2 years of after High School professional training or college	22	34.38%	16	21.05 %	38	55.43%
	2-year College Degree	8	12.50%	11	14.47 %	19	26.97%
	4-year College Degree or higher	4	6.25%	6	7.89%	10	14.14%
Native Language	English	59	92.19%	58	76.32 %	117	168.51%
	Spanish	2	3.13%	9	11.84 %	11	14.97%
	Other	3	4.69%	9	11.84 %	12	16.53%
	Single	21	32.80%	19	25.00 %	40	57.80%
Marital status	Married	36	56.30%	50	65.80 %	86	122.10%
	Widowed	0	0%	2	2.60%	2	2.60%
	Divorced	7	10.90%	5	6.60%	12	17.50%
Average years of driving experience	Year	13		14		13	
	Month	3		3		9	
Average of Work overload		3.62		4.07		3.85	
Average of Social stressor		3.01		3.2		3.11	
Average of Physical stressor		5.3		4.96		5.13	
Average of Fairness of Rewards		4.72		4.91		4.83	
Average of Job Control		4.56		5.29		4.96	
Average of Financial Stressor		4.11		3.86		3.99	

Work overload refers to the extent to which work assigned is perceived to be completed within the time given. For example, the driver may be asked to make a delivery from point A to point B which in reality takes 8 hours but instead is given only 7.5 hours to complete the journey. This could happen because the dispatcher does not factor in the speed zones or the time taken for a driver to drive slowly through narrow roads. This in turn results in stress since the driver is constantly worried about delivering the cargo in time. From table 7, we can see that independent owner operators have more workload (average = 4.07) compared to company drivers (average = 3.62). Higher workload translates into higher job demand leading to elevated stress and reduced efficiency. This suggests that independent owner operators are more likely to be exhausted from work and as a consequence, are more likely to underperform.

Social stressors refer to the extent to which interactions or the lack thereof, with coworkers, dispatchers and supervisor is perceived to be unhealthy. This also includes the stress experienced due to inability of the driver to stay connected to family members. For example, the lack of respect from dispatchers (arising from lack of knowledge of respective roles and the stress involved), disrespectful treatment from the people at the loading dock or the absence from loved ones and friends with strong social support may stress drivers. Research on occupational stress proposes that such kind of negative experience may lead to distress and frustration, hence causing work exhaustion. From table 7, we can see that independent owner operators (average = 3.2) are more likely to be stressed with respect to social interactions at work place and with family compared to company drivers (average = 3.01). This is because independent owner operators in our sample consisted of long haul truck drivers who spend majority of their time

alone on the road and away from their family compared to company drivers who interact with dispatchers or supervisors and get to go home at the end of the work day.

Physical environment stressors refers to the extent to which the physical surrounding of workplace affects the physical and mental health of the worker, for example, traffic congestion, bad weather, road blocks etc. Physical environment can interfere with optimum functioning of drivers, and may affect the driver both physiologically and psychologically, thus inducing work exhaustion, and eventually reducing job performance. From table 7, we can see that out of all the stressors, physical stressor affects the driver most, especially the company drivers (average 5.3) as opposed to independent owner operated drivers (average = 4.96). This is because company drivers spend majority of their time driving within the city and thus are more often affected by heavy traffic during peak hours, narrow roads and daily check in and check out at the yard gate.

Job control or job autonomy refers to the extent to which a driver perceives that he has the discretion and independence to do his job (Bakker & Demerouti, 2007). As expected, table 7 confirms that independent owner operated have exercise a higher level of job control (average=5.29) compared to company drivers (average = 4.56). This is because independent owner operated drivers are drivers who usually own their truck. They either contract with a trucking firm to haul freight for the company using their own truck or they own their own authority to haul freight. As a result they are less answerable to the company about how they go about doing their daily job duties compared to a company driver who uses the company's truck to haul freight.

From table 7, we can also see that the average value of financial stressor among all drivers is 3.99 implying that on average, drivers are less satisfied with their pay structure in the company. To be specific, owner operators are less satisfied with their wages as compared to independent company operators. Past literature has consistently identified pay as a significant predictor of turnover intention since it does incentivize an employee to perform to the best of his capability. As a result of this high turnover rate, a company might spend time and other resources in attracting new drivers and training them. Increasing pay might prove to be a viable solution for decreasing driver turnover.

Next, we proceed to analyzing the research variables introduced in the proposed IT Stress: Inducer-Reducer model.

C. IT Stress: Inducer – Reducer Model Analysis

In, this section, we test the relationships proposed in the *IT stress: Inducer-Reducer Model* using a structural equation modeling approach. We test whether

- IT monitoring stressor and IT learning stressor have a positive effect on drivers' work exhaustion
- Drivers' work exhaustion has a negative effect on drivers' job satisfaction
- Drivers' work exhaustion has a negative effect on their turn over intention
- Drivers' job satisfaction has a positive effect on their turn over intention

- IT information support, IT communication support, and IT educational support has a positive effect on drivers' job satisfaction
- The above mentioned relationships differ between company drivers and owner operated drivers.

Structural equation modeling (SEM) was used to analyze our model. SEM is a technique used to test multiple relationships simultaneously. The technique is comprised of two stages. The first stage, known as the measurement model analyses the reliability, convergent validity and discriminant validity of the variables proposed in the *IT Stress: Inducer-Reducer Model*[4]. The second stage, known as the structural model, consists of examining the strength and the directionality of the relationships proposed in the *IT Stress: Inducer-Reducer Model*.

The structural model of the *IT Stress: Inducer-Reducer Model* is summarized in Table 11 and Figure 6. The explained variances (R^2) value in Figure 6 indicate that the proposed study model explained 18% of the variance for work exhaustion, 25% of the variance in job satisfaction and 39% of the variance in turnover intention of truck drivers. As for the results of testing the hypotheses, we found that

- Work exhaustion is influenced by IT monitoring stressor (H1, t=2.691, $p<0.01$) and IT learning stressor (H2, t=2.261, $p<0.05$)
- Work exhaustion has a significantly negative effect on job satisfaction (H6, t=1.925, $p<0.05$).

[4] Readers are advised to refer to Appendix C for discussion on the measurement model.

- Work exhaustion has a significant positive effect on turnover intention (H7, t=2.499, $p<0.01$)
- Higher job satisfaction had a significantly negative influence on turnover intention (H8, t=3.682, $p<0.001$)
- The path from informational support to job satisfaction was significant (H3, t=2.441, $p<0.01$) and the path from communicational support to job satisfaction was also significant (H4, t=1.787, $p<0.05$). However, contrary to our expectations, educational support was not significantly associated with job satisfaction (H5, t=0.729).
- None of the control variables (age, income, education and amount of IT usage) proved to be significant

Table 11 Results of Hypothesis testing of the Overall Study Model

		Path coefficient	t-value	*p*-value	Support
H 1	IT monitoring stressor -> Work exhaustion	0.29	2.691**	0.004	Yes
H 2	IT learning stressor -> Work exhaustion	0.17	2.261*	0.013	Yes
H 3	IT Information support -> Job satisfaction	0.25	2.441**	0.008	Yes
H 4	IT Communication support -> Job satisfaction	0.20	1.787*	0.038	Yes
H 5	IT Educational support -> Job satisfaction	0.08	0.729	0.234	No
H 6	Work exhaustion -> Job satisfaction	-0.20	1.925*	0.028	Yes
H 7	Work exhaustion -> Turnover intention	0.21	2.499**	0.007	Yes
H 8	Job satisfaction -> Turnover intention	-0.39	3.682***	0.000	Yes
Control 1	Age -> Work exhaustion	-0.07	0.825	0.205	No
Control 2	Income -> Work exhaustion	-0.09	0.950	0.172	No
Control 3	Education -> Work exhaustion	0.00	0.006	0.497	No
Control 4	Amount of IT usage -> Work exhaustion	0.03	0.325	0.373	No

Control 5	Amount of IT usage -> Job satisfaction	-0.03	0.319	0.375	No
Control 6	Job control -> Turnover intention	-0.09	0.795	0.214	No
Control 7	Fairness of rewards-> Turnover intention	-0.13	0.926	0.178	No

*(Note: ***p<0.001, ** p<0.01,* p<0.05)*

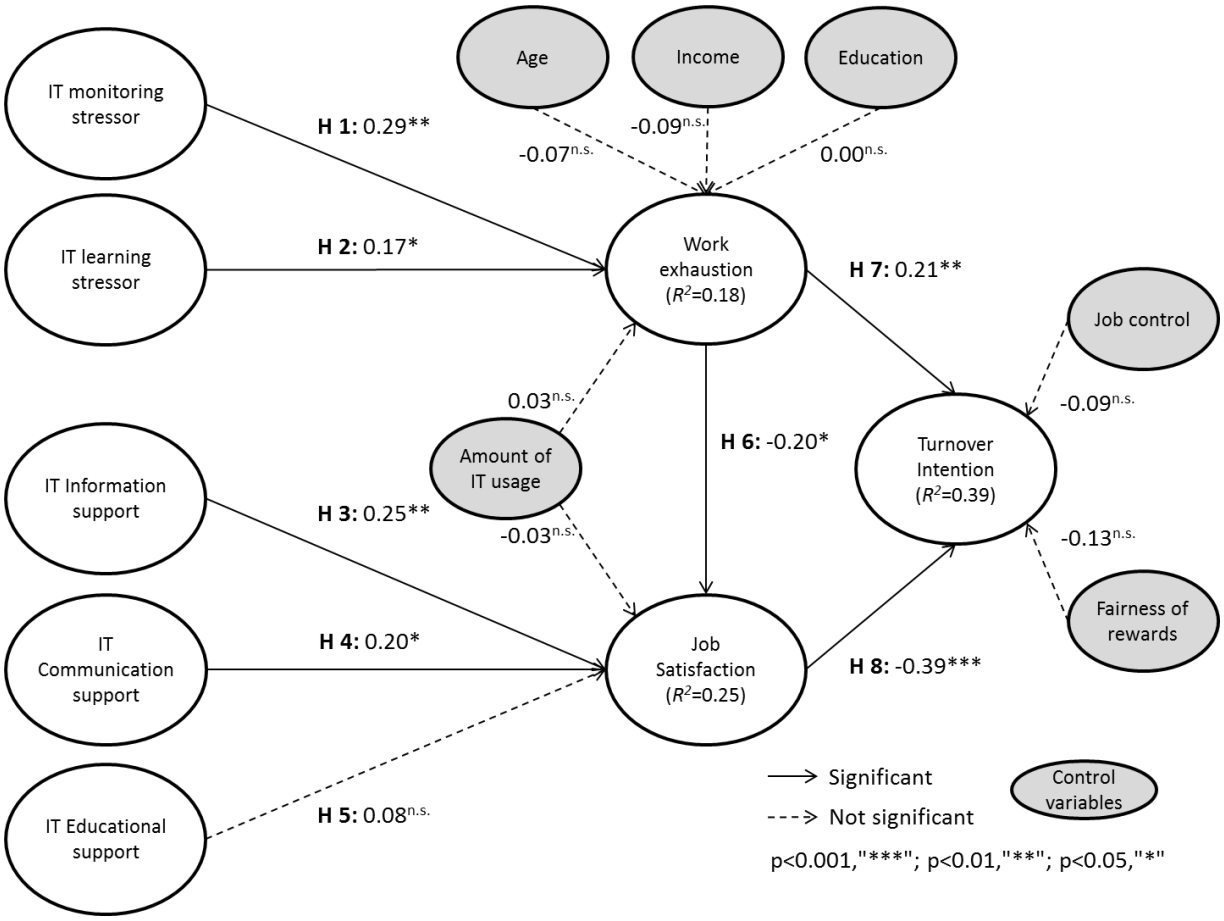

Figure 6 Overall Study Results

D. Comparing company drivers and owner-operated drivers

To examine the differences of the results of the structural model analysis between company drivers and owner-operated drivers, this study performed a subgroup analysis. The results of sub-group analysis are shown in Table 12. Figure 7 summarizes the results of the PLS analysis with company drivers sample and Figure 8 shows them with owner-operated drivers sample.

For the company drivers' sample,

- The path from IT monitoring stressor to work exhaustion was significant (H1, t=4.057, p<0.001), while the path from IT learning stressor to work exhaustion was not significant (H2, t=0.314)
- Work exhaustion had a significant negative effect on job satisfaction (H6, t=3.767, p<0.001).
- Work exhaustion had a significant positive effect on turnover intention (H7, t=3.809, p<0.001).
- Job satisfaction has a significant negative effect on turnover intention (H8, t=6.900, p<0.001)
- Contrary to our expectations, all paths from informational support (H3, t=0.983), communicational support (H4, t=0.315), and educational support (H5, t=0.561) to job satisfaction were not significant.

- However, the increased use of IT was a significant factor predicting higher job satisfaction.

For the owner-operated drivers sample,

- Both IT monitoring stressor (H1, t=2.110, $p<0.05$) and IT learning stressor (H2, t=3.084, $p<0.01$) were significantly associated with work exhaustion.
- Work exhaustion did not have a significant negative effect on job satisfaction (H6, t=0.844)
- Work exhaustion did not have a significant positive effect on turnover intention (H7, t=0.872.
- However, job satisfaction was significantly associated with turnover intention (H8, t=2.056, $p<0.05$).
- In terms of IT support, the path from informational support to job satisfaction (H3, t=2.803, $p<0.01$) and the path from communicational support to job satisfaction (H4, t=2.343, $p<0.05$) were positive and significant. However, educational support was still not significantly associated with job satisfaction (H5, t=0.642).

Table 12 Comparison of structural paths between company drivers and owner-operated drivers

	Company driver				Owner-operated driver			
	Path coefficient	t-value	p-value	Support	Path coefficient	t-value	p-value	Support
H 1	0.41	4.057***	0	Yes	0.25	2.110*	0.019	Yes
H 2	0.03	0.314	0.377	No	0.27	3.084**	0.001	Yes
H 3	0.1	0.983	0.165	No	0.35	2.803**	0.003	Yes
H 4	0.03	0.315	0.377	No	0.28	2.343*	0.011	Yes
H 5	0.05	0.561	0.288	No	0.08	0.642	0.261	No
H 6	-0.43	3.767***	0	Yes	-0.07	0.844	0.201	No
H 7	0.31	3.809***	0	Yes	0.09	0.872	0.193	No
H 8	-0.51	6.900***	0	Yes	-0.26	2.056*	0.022	Yes
Control paths								
Control 1	0.04	0.41	0.341	No	-0.15	1.740*	0.043	Yes
Control 2	0	0.021	0.492	No	-0.08	0.75	0.228	No
Control 3	0.15	1.718*	0.045	Yes	-0.11	1.292	0.1	No
Control 4	0.1	0.962	0.17	No	0.04	0.326	0.373	No
Control 5	0.17	1.726*	0.045	Yes	-0.1	0.964	0.169	No
Control 6	-0.08	0.894	0.187	No	-0.05	0.418	0.338	No
Control 7	-0.01	0.125	0.45	No	-0.23	1.49	0.07	No

(Note 1: *Control 1; Age -> Work exhaustion, Control 2; Income -> Work exhaustion, Control 3; Education -> Work exhaustion, Control 4; IT use experience -> Work exhaustion, Control 5; IT use experience -> Job satisfaction, Control 6; Job control -> Turnover intention, Control 7; Fairness of rewards-> Turnover intention.* Note 2: ***p<0.001, ** p<0.01,* p<0.05)

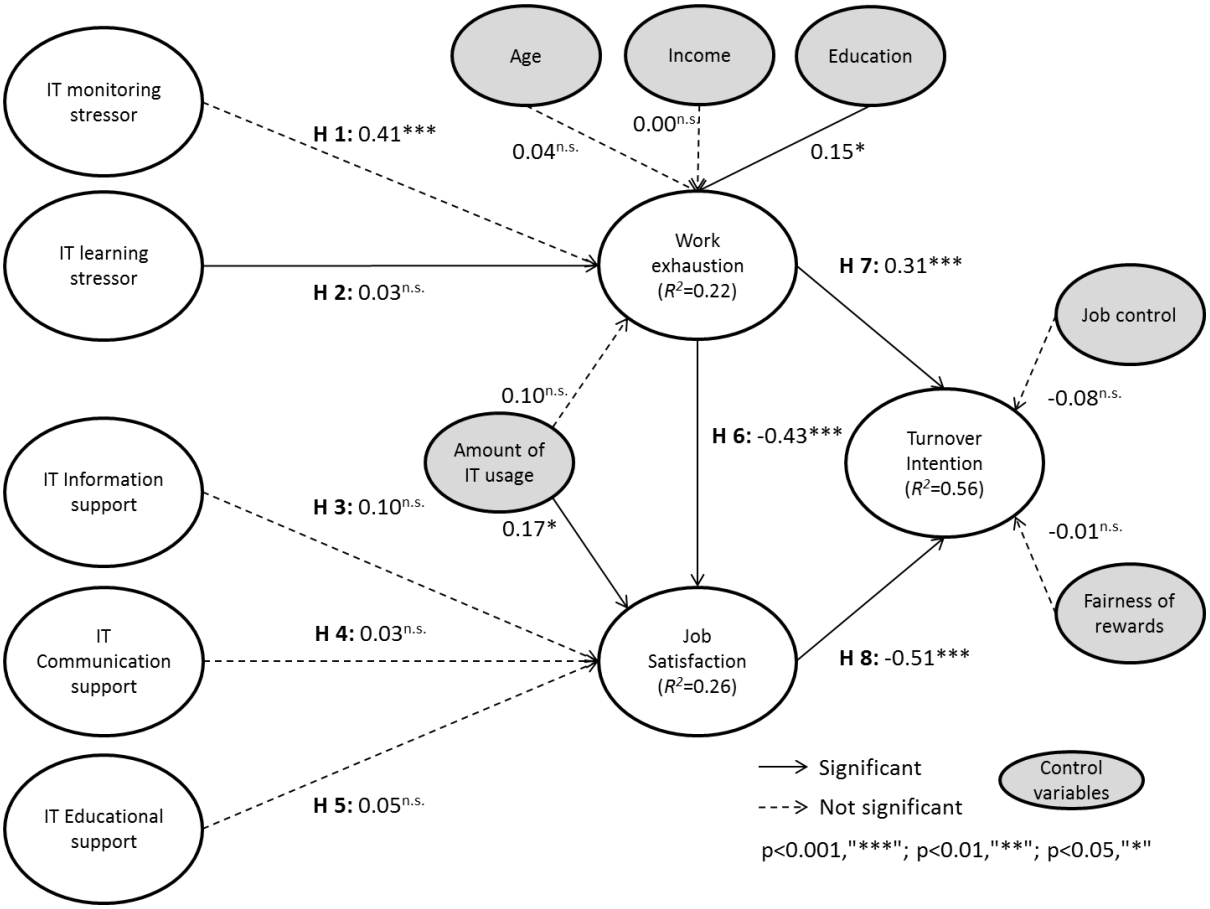

Figure 7 Study results for company drivers

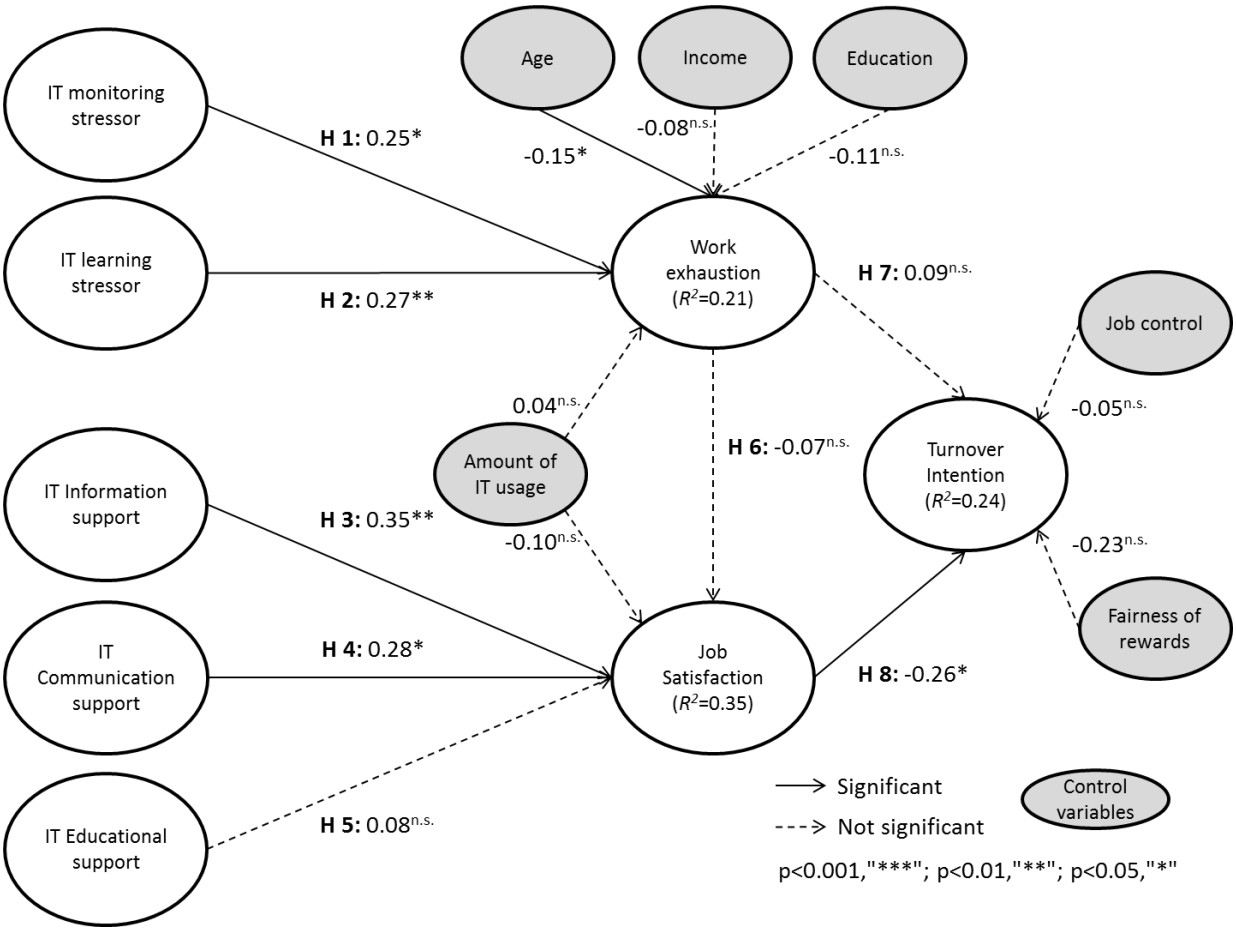

Figure 8 Study results for Independent owner-operated drivers

Chapter 6: Discussion

This study has investigated simultaneously the stress inducing effects of IT on driver's work exhaustion and the stress reducing effects of IT on driver's job satisfaction, in relation to his turnover intention. Stress inducing effects examined include IT learning and IT monitoring stressors, while stress reducing effects of IT include Information support, Communication support, and Educational support. As truck drivers increasingly use technology to complete their daily tasks, investigating the dual impacts of IT on truckers' turnover intention also becomes important. The study should help managers predict the turnover of employees by using it as a tool to analyze where their employees stand. Based on this analysis, the managers can develop coping strategies to reduce stress and improve their employee retention.

A. Key Findings

Finding 1: IT monitoring stressor and IT learning stressor have a significant impact on drivers' work exhaustion

Regardless of age, income and education of the driver, IT monitoring stressor affects both company drivers and independent owner operated drivers implying that it is a major and a significant factor contributing to work exhaustion among all drivers regardless of their type. Drivers are recognizing that they are being monitored by IT. The extent to which this monitoring is viewed in a negative or over controlling way can result in work exhaustion. This was particularly true for company drivers who may associate monitoring directly to their well-being in the company given their direct dependence on their employer. Companies are, and will

continue, receiving vast amounts of information from the IT monitoring all aspects of a driver's job. The extent to which a company can frame the use of this monitored information in a more positive light may result in less stress and associated work exhaustion. Developing programs around positive self-control through IT monitored feedback might be the first step and could be incorporated into the next generation of EOBR whereby drivers directly interact with output data of EOBR to improve their driving behavior. At the next level, companies might establish threshold levels whereby remedial training to correct particularly problematic behavior can be routinized, e.g. the on-road training currently being done at this study's research site regarding gear shifting and braking when verbal feedback has not resulted in behavioral improvements. Finally, financial incentives might also be incorporated into a job improvement program so that the IT monitoring can be viewed as an opportunity for reward and not just punishment for good job performance.

IT learning stressor also showed a significant positive effect on work exhaustion for drivers. Drivers spend significant amount of time and effort to learn and use EOBR which in turn induces work exhaustion. The extent to which companies are able to develop more intensive training programs may help alleviate drivers of the stress associated with learning new technologies, and as a result, their work exhaustion. Apart from training the driver on how to use the features of the IT, training programs can also incorporate material that gives drivers an understanding of how the features of IT make the driver's job easier. An understanding of how to use the features of IT in conjunction with why to use the features of IT would give drivers a

more pleasant experience with using EOBR which in turn may help reduce the stress and the associated work exhaustion.

Finding 2: Drivers are more likely to quit when they experience work exhaustion due to being monitored by IT and learning IT. Also, as might be expected when truckers are less satisfied with their job, they are more likely to quit.

Similar to past literature, known causal relationships between work exhaustion, job satisfaction and truck driver turnover intention holds true for IT related variables as well i.e. the higher the work exhaustion among drivers, the lower the job satisfaction and the higher the likelihood of quitting the organization. Our results indicate that, regardless of the type of driver, work exhaustion experienced due to IT monitoring and IT learning stressor, and job satisfaction experienced due to IT information support and IT communication support explained a significant 39% of the variance in turnover intention among drivers. Companies may need to implement strategies to reduce work exhaustion and increase job satisfaction to increase truck driver retention by enhancing perceptions of advantageous support available from the use of IT.

Finding 3: IT enabled Information support and communication support results in increased driver's job satisfaction.

Although introduction of IT has an unintended negative impact on drivers' work exhaustion, introduction of IT also leads to favorable results. Information support and communication support from IT explained significant amount of variance in job satisfaction (R^2 = 25%). Many trucking companies are increasingly investing in IT that supports the daily operations of the truck

driver. The results of this study show that support available from IT will actually result in a more satisfied employee and as a result will be less likely to quit. As a recommendation, in addition to continually investing in IT, companies can also promote the use of IT by increasing awareness about support available from IT to drivers. Increase in such awareness may consequently cause increase in job satisfaction and retention of drivers.

Finding 4: There are differences in how IT affects company operated driver and independent owner operators.

Our study identified three significant differences in how IT affects company operated drivers and owner operated drivers.

1. **IT Learning Differences:**

While IT leaning stressor causes work exhaustion among independent owner operated drivers, this link was seen to be insignificant for company drivers. This is probably because independent owner drivers operate their own truck and usually haul freight for different companies who use a different configuration of EOBR. Therefore, independent owner operators have to acquaint themselves with the IT every time they are employed with a different company and as a result there is a learning curve associated with using the new IT. Company drivers, on the other hand, usually work with the same company for longer period of time. Over time, they get accustomed to the IT and as a result are more familiar with using the IT to complete their daily tasks. As a recommendation, managers should factor in the experience with using IT as one

of the criteria upon hiring a driver. More thorough training should be given to those who have less experience with using the organizations current IT.

2. Exhaustion and Satisfaction Differences:

For company drivers, work exhaustion has a significant positive relationship with turnover intention and a significant negative relationship with job satisfaction. However, these relationships did not hold true for independent owner operated driver. Furthermore, work exhaustion and job satisfaction explained a highly significant amount of variance in turnover intention (R^2 = 56%) for company drivers. However, for independent owner operated drivers, this variance declined drastically to 24%. While the percentage variance explained by IT stressors for work exhaustion remains about the same, (R^2 = 0.21 for company drivers and R^2 = 0.22 for independent owner operated drivers), the direct effect of work exhaustion on job satisfaction remained significant for company driver but became insignificant for independent owner operated driver. A possible explanation for the anomaly could be the existence of a third variable which mediates the link between work exhaustion and job satisfaction and is explained by the independence or expectations of work performed by independent owner operated drivers. Future research should explore this mediating relationship to obtain a more holistic model that can explain turnover intention among independent owner operated drivers.

3. Information and Communication Support Differences:

Information support and communication support were significant predictors of job satisfaction for owner operated drivers but insignificant predictors for company drivers. However, the amount of IT usage was significant predictor of job satisfaction for company drivers but insignificant for owner operated driver. Taken together these results suggest that, regardless of being a heavy users or light users of the IT, owner operated drivers find information and communication support available from IT to be useful and an important factor in job satisfaction. On the other hand, for company drivers, who have become more accustomed to using the same IT for years, do not perceive information and communication support from IT as an important factor in job satisfaction. Rather, the amount of use of IT becomes an important predictor of job satisfaction; in essence they receive marginally increasing job satisfaction with increased use of IT. As a recommendation, managers should develop training programs that are geared towards educating the company driver on the numerous features of IT available for them. Raising such awareness to company drivers will increase their IT usage thus leading to job satisfaction.

B. Research Implications

While this paper has explored the competing role of IT as related to driver's work exhaustion and job satisfaction, it is important to raise new research questions to light.

This study explicitly identifies IT's capability in reducing stress, thereby significantly extending the present understanding of technostress (Ragu-Nathan et al. 2008; Tarafdar et al. 2007). In addition to solely considering the stress inducing effects of IT on truck drivers, we can

now describe stress reducing effects of IT. Future research should consider developing a classification schema based on exactly what characteristics of IT induce stress and what characteristics of IT reduce stress in a truck driver so that when new information technologies are introduced for truck drivers' use, they can be evaluated on their potential to induce or reduce stress before a decision to fully implement the IT is made on a large scale.

Rather than just asking "What are the IT stressors and IT support variables that affect truck drivers?" it is also important to ask "How can we influence the manifestation of stress through IT? As resources like the IT support variable described in this study can have the capability to mitigate the effect of stressors on work exhaustion, future research should examine the moderating effects of IT resources and other job resources e.g. social support on the relationship between stressors and work exhaustion to understand through what mechanism managers can inhibit the stress inducing effects of IT stressors on drivers' work exhaustion.

One of the biggest benefits of our proposed conceptual model is that it might be applied to other work environment. We believe that our model is not constrained to any particular occupation; in fact, it is developed to understand the impacts of IT across different occupations in an organization, for example, trucking dispatchers whose job description is also known to be stressful. Therefore, future research should study the validity and extend the generalizability of the *IT Stress: Inducer-Reducer Model* to other work contexts that are seldom studied in the transportation literature

Chapter 7: Conclusion

This report provides trucking firms with the means to begin to implement a more effective driver recruitment and retention strategy by examining sources of the driver shortage problem related to the use of Electronic Onboard Recording Device. We propose the *IT Stress: Inducer-Reducer Model* to examine the stress inducing and the stress reducing aspects of IT affects drivers' turnover intention in relation to work exhaustion and job satisfaction. We find that IT monitoring stressor and IT learning stressor are two aspects of IT that cause work exhaustion which in turn leads to lower job satisfaction and high turnover intention among truck drivers. While our study shows that technology has the capability to induce stress, it also possesses the ability to reduce stress and produce more satisfied workers. We find that IT information support and IT communication support are the two aspects of IT that significantly predict job satisfaction which in turn reduces the likelihood of a truck driver to quit. By identifying these stress reducing aspects, we speak to a wide-ranging managerial interest in understanding how to use IT to reduce the negative impacts of IT related stress on driver turnover. Furthermore, we find that the *IT Stress: Inducer-Reducer Model* behaves differently for company driver and independent owner operated driver. In showing that IT related stress is dependent on the type of driver, we suggest that individual specific approaches are required for treating IT related stress.

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Acronyms

1. ANOVA – Analysis of Variance
2. AVE – Average Variance Extracted
3. CD – Company Drivers
4. CFA – Confirmatory Factor Analysis
5. CR – Composite Reliability
6. EOBR – Electronic Onboard Recording Device
7. FMCSA – Federal Motor Carrier Safety Administration
8. ID – Independent Owner operated drivers
9. IT – Information Technology
10. JDR – Job Demand-Resource Model
11. LTL – Less-than-Truckload
12. PLS – Partial Least Square
13. SEM – Structural Equation Modeling
14. TL – Truckload

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Appendix A. Truck Driver Survey Questionnaires

A. <English version>

Q1 Are you a short-haul driver or long-haul driver?

- ❍ I'm a short-haul driver. (1)
- ❍ I'm a long-haul driver. (2)

Q2 Are you a company driver or an independent owner-operated driver?

- ❍ I'm a company driver. (1)
- ❍ I'm an independent owner-operated driver. (2)

Q3 What is your gender?

- ❍ Female (1)
- ❍ Male (2)
- ❍ Not declared (3)

Q4 What is your current age?

- ❍ 25 to 34 (1)
- ❍ 35 to 44 (2)
- ❍ 45 to 54 (3)
- ❍ 55 to 64 (4)
- ❍ 65 or over (5)

Q5 What is your annual income range?

- ❍ Less than $20,000 (1)
- ❍ $20,000 - $29,999 (2)
- ❍ $30,000 - $39,999 (3)
- ❍ $40,000 - $49,999 (4)
- ❍ $50,000 - $59,999 (5)
- ❍ $60,000 or over (6)

Q6 What is the highest level of education you have completed?

- ❍ Less than High School (1)
- ❍ High School Degree / GED (2)
- ❍ Less than 2 years of after High School professional training or college (3)
- ❍ 2-year College Degree (4)
- ❍ 4-year College Degree or higher (5)

Q7 What is your first (native) language?

- ❍ English (1)
- ❍ Spanish (2)
- ❍ Other (3)

Q8 How long have you been driving commercial trucks?

Years ( )
Months ( )

Q9 How long have you been driving for this company?

Years ( )
Months ( )

Q10 Do you currently use the In-cab Information Technology (IT) such as PeopleNet in your job?

- ❍ Yes (1)
- ❍ No (2)

Q11 How long have you been using the In-cab IT?

- ❍ Less than 3 months (1)
- ❍ 3-6 months (2)
- ❍ 6 months - 1 year (3)
- ❍ 1 - 2 years (4)
- ❍ More than 2 years (5)

Q12 Indicate your marital status.

- ❍ Single (1)
- ❍ Married (2)
- ❍ Widowed (3)
- ❍ Divorced (4)

Q13 In-cab Information Technology (IT) Stressor

Please tell how us how much you agree or disagree with the following (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree nor disagree, 5 = somewhat agree, 6 = agree, 7 = strongly agree).

	1	2	3	4	5	6	7
I wish I had more opportunity to learn how to get additional information out of the In-cab IT features to do my job. (1)							

I wish I had more time to learn how to extensively use all the features of the In-cab IT to do my job better. (2) I wish I knew how to get the features of In-cab IT to do some additional things that would help me in my job. (3) I wish the In-cab IT better guided me in getting additional information from its features to do my job. (4)							

Q14 In-cab Information Technology (IT) monitoring stressor

Please tell how us how much you agree or disagree with the following (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree nor disagree, 5 = somewhat agree, 6 = agree, 7 = strongly agree).

	1	2	3	4	5	6	7
I sometimes feel concerned because my driving is constantly monitored by the In-cab IT. (1) I sometimes feel pressure because my company carefully reviews logs produced by the In-cab IT. (2) I sometimes feel concerned because the messages I send through the In-cab IT are being constantly monitored. (3) I sometimes feel pressure because the In-cab IT is always checking my activities to ensure that I meet requirements. (4)							

Q15 Physical Environment Stressor

Please tell how us how much you agree or disagree with the following (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree nor disagree, 5 = somewhat agree, 6 = agree, 7 = strongly agree).

	1	2	3	4	5	6	7
Driving in unexpected bad weather can be very stressful. (1)							
Driving delays due to slow security checkpoints can be very stressful. (2)							
Driving on an unfamiliar road can be very stressful. (3)							
Driving in a heavy traffic jam can be very stressful. (4)							
Driving without the ability to take a needed rest stop can be very stressful. (5)							

Q16 Social Stressor

Please tell how us how much you agree or disagree with the following (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree nor disagree, 5 = somewhat agree, 6 = agree, 7 = strongly agree).

	1	2	3	4	5	6	7
Sometimes on my job, I feel like others cannot access me. (1)							
Sometimes while I am driving, I feel out of touch with others. (2)							

Sometimes while I am on the road, I feel inaccessible to others. (3) Sometimes on my job, I feel like I cannot access others. (4)							

Q17 Work overload

Please tell how us how much you agree or disagree with the following (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree nor disagree, 5 = somewhat agree, 6 = agree, 7 = strongly agree).

	1	2	3	4	5	6	7
I often feel busy or rushed in getting all my work completed. (1) I often feel the amount of work that I have to do is too much in the time given. (2) I often feel pressured in getting all my work done. (3) I often feel it is a challenge getting all my work done. (4)							

Q18 Work Exhaustion

(1 = never, 2 = a few times a year, 3 = once a month, 4 = a few times a month, 5 = once a week, 6 = a few times a week, 7 = daily)

	1	2	3	4	5	6	7
I feel used up at the end of the work day. (1) I feel tired when I get up in the morning and have to face another day at work. (2)							

I feel burned out from my work. (3) I feel completely exhausted from my work. (4)							

Q19 Information Support

Please tell how us how much you agree or disagree with the following (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree nor disagree, 5 = somewhat agree, 6 = agree, 7 = strongly agree).

	1	2	3	4	5	6	7
I am able to do my job much better when I use the information from the In-cab IT. (1) In-cab IT gives me information that is very helpful in doing my job. (2) My job becomes much easier when I use Information from the In-cab IT. (3) I need the Information available through In-cab IT to do my job well. (4)							

Q20 In-cab IT User Support

Please tell how us how much you agree or disagree with the following (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree nor disagree, 5 = somewhat agree, 6 = agree, 7 = strongly agree).

	1	2	3	4	5	6	7
In-cab IT is well designed to guide me in the use of its features. (1)							

In-cab IT assists me when I need help using its features. (2) In-cab IT guides me easily as I use its features. (3) In-cab IT is designed in a way that really helps me use its features. (4)							

Q21 Communication Support

Please tell how us how much you agree or disagree with the following (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree nor disagree, 5 = somewhat agree, 6 = agree, 7 = strongly agree).

	1	2	3	4	5	6	7
In-Cab IT enables others to have access to me. (1) In-cab IT makes me accessible to others. (2) The use of In-cab IT enables me to be in touch with others. (3) In-cab IT enables me to access others. (4)							

Q22 Turnover Intention

How likely is it that you will... (1 = very unlikely, 2 = unlikely, 3 = somewhat unlikely, 4 = neither likely nor unlikely, 5 = somewhat likely, 6 = likely, 7 = very likely). (*: reversed scale)

	1	2	3	4	5	6	7
...consider taking a job with a different company if a better opportunity came up in the next year? (1)							

...be working with this company five years from now? (2)*							
...be working with this company three years from now? (3)*							
...consider taking a job at a different company in the next year? (4)							

Q23 Job satisfaction

Please tell how us how much you agree or disagree with the following (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree nor disagree, 5 = somewhat agree, 6 = agree, 7 = strongly agree).

	1	2	3	4	5	6	7
My job at this company is very enjoyable. (1)							
I really like working at this company. (2)							
I feel a strong sense of pride in doing my job at this company. (3)							
I am very satisfied with my job at this company. (4)							

Q24 Financial stressor

Please tell how us how much you agree or disagree with the following (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither agree nor disagree, 5 = somewhat agree, 6 = agree, 7 = strongly agree). (*: reversed scale)

	1	2	3	4	5	6	7
This company pays well. (1)*							

I make good money at this company. (2)* The pay in this company is better than in comparable trucking companies. (3)* I live comfortably on my pay working with this company. (4)*							

B. <Spanish version>

Q1 Usted es un conductor de corta distancia (short haul) o controlador de larga distancia (long haul)?

- ❍ Soy un conductor de corta distancia.
- ❍ Soy un conductor de larga distancia.

Q2 ¿Es usted un conductor de una compañía (company driver) o un propietario independiente (independent owner operated driver)?

- ❍ Soy un conductor de la compañía.
- ❍ Soy un conductor propietario independiente.

Q3 ¿Cuál es su género?

- ❍ Mujer
- ❍ Hombre
- ❍ No declarado

Q4 ¿Cuál es su edad actual?

- ❍ 25 - 34
- ❍ 35 - 44
- ❍ 45 - 54
- ❍ 55 - 64
- ❍ 65 - más

Q5 ¿Cuál es su nivel de ingreso anual?

- ❍ Menos de $20,000
- ❍ $20,000 - $29,999
- ❍ $30,000 - $39,999
- ❍ $40,000 - $49,999
- ❍ $50,000 - $59,999
- ❍ $60,000 o más

Q6 ¿Cuál es el nivel educativo más alto que ha completado?

- ❍ Menos de la Escuela Secundaria
- ❍ Grado de la Escuela Secundaria / GED
- ❍ Menos de 2 años de después de la Escuela Preparatoria de formación profesional o universitaria
- ❍ Dos años de colegio/universidad
- ❍ 4 años de colegio o superior

Q7 ¿Cuál es su lenguaje principal (nativo)?

- ❍ Inglés
- ❍ Español
- ❍ Otro

Q8 ¿Cuánto tiempo ha estado conduciendo camiones comerciales?

Años ( )
Meses ( )

Q9 ¿Cuánto tiempo ha estado manejando para empresa?

Años ( )
Meses ( )

Q10 ¿Utiliza actualmente la tecnología de información en la cabina (In-Cab) tal como PeopleNet en su trabajo?

- ❍ Sí
- ❍ No

Q11 ¿Cuánto tiempo ha estado usando la tecnología en cabina "In-cab" ?

- ❍ Menos de 3 meses
- ❍ 3-6 meses
- ❍ 6 meses a 1 año
- ❍ 1 - 2 años
- ❍ Más de 2 años

Q12 Indique su estado civil.

- ❍ Soltero
- ❍ Casado
- ❍ Viudo
- ❍ Divorciado

Q13 Estresante en el aprendizaje de las Tecnologías de información (TI) en cabina

Por favor díganos cuanto esta de acuerdo o desacuerdo con lo siguiente (1 = Totalmente en desacuerdo, 2 = En Desacuerdo, 3 = Algo en desacuerdo, 4 = Ni de acuerdo ni en desacuerdo, 5 = Algo de acuerdo, 6 = De acuerdo, 7 = Muy en acuerdo).

	1	2	3	4	5	6	7
Me gustaría tener más oportunidades para aprender a obtener información adicional de las TI en Cabina (PeopleNet) para hacer mi trabajo.							
Me gustaría tener más tiempo para aprender a utilizar ampliamente todas las características de las TI en Cabina (PeopleNet) para hacer mi mejor trabajo.							
Me gustaría saber cómo conseguir las características de las TI en Cabina (PeopleNet) para hacer algunas cosas adicionales que me ayudan en mi trabajo.							
Me gustaría que las TI en Cabina (PeopleNet) me guiara mejor en la obtención de información adicional para hacer mi trabajo.							

Q14 Estresante de Monitoreo de las Tecnologías de información (TI) en la cabina

Por favor díganos cuanto esta de acuerdo o desacuerdo con lo siguiente (1 = Totalmente en desacuerdo, 2 = En Desacuerdo, 3 = Algo en desacuerdo, 4 = Ni de acuerdo ni en desacuerdo, 5 = Algo de acuerdo, 6 = De acuerdo, 7 = Muy en acuerdo).

	1	2	3	4	5	6	7
A veces me siento preocupado porque mi forma de conducir es constantemente supervisada por las TI en la cabina.							
A veces siento presión porque mi compañía revisa cuidadosamente los registros producidos por las TI en la cabina.							
A veces me siento preocupado porque los mensajes que envío a través de las TI en la cabina están siendo constantemente monitoreados.							
A veces siento presión porque las TI en la cabina está siempre revisando mis actividades para asegurar que cumplo con los requisitos.							

Q15 Estresante Ambiente Físico

Por favor díganos cuanto esta de acuerdo o desacuerdo con lo siguiente (1 = Totalmente en desacuerdo, 2 = En Desacuerdo, 3 = Algo en desacuerdo, 4 = Ni de acuerdo ni en desacuerdo, 5 = Algo de acuerdo, 6 = De acuerdo, 7 = Muy en acuerdo).

	1	2	3	4	5	6	7
Conducir en mal clima inesperado puede ser muy estresante.							
Retrasos debido a la lentitud en los controles de seguridad pueden ser muy estresantes.							
Conduciendo por una carretera desconocida puede ser muy estresante.							

El conducircon mucha congestion de trafico puede ser muy estresante. Conducir sin la capacidad de tomar un descanso necesario puede ser muy estresante.							

Q16 Estresante Social

Por favor díganos cuanto esta de acuerdo o desacuerdo con lo siguiente (1 = Totalmente en desacuerdo, 2 = En Desacuerdo, 3 = Algo en desacuerdo, 4 = Ni de acuerdo ni en desacuerdo, 5 = Algo de acuerdo, 6 = De acuerdo, 7 = Muy en acuerdo).

	1	2	3	4	5	6	7
A veces en mi trabajo, siento que los demás no me pueden contactar. A veces, mientras voy conduciendo, me siento fuera de contacto. A veces, mientras estoy en el camino, me siento inaccesible para otros. A veces en mi trabajo, siento que no puedo contactar a los demás.							

Q17 Sobrecarga de Trabajo

Por favor díganos cuanto esta de acuerdo o desacuerdo con lo siguiente (1 = Totalmente en desacuerdo, 2 = En Desacuerdo, 3 = Algo en desacuerdo, 4 = Ni de acuerdo ni en desacuerdo, 5 = Algo de acuerdo, 6 = De acuerdo, 7 = Muy en acuerdo).

	1	2	3	4	5	6	7
A menudo me siento ocupado o apresurado para completar todo mi trabajo.							

A menudo siento que la cantidad de trabajo que tengo que hacer es demasiada para el tiempo dado.							
A menudo me siento presionado para hacer todo mi trabajo.							
A menudo me siento que es un reto hacer todo mi trabajo.							

Q18 Agotamiento Laboral

(1 = Nunca, 2 = Varias veces al año, 3 = Una vez al mes, 4 = Varias veces al mes, 5 = Una vez por semana, 6 = Varias veces a la semana, 7 = Diario)

	1	2	3	4	5	6	7
Me siento agotado al final de la jornada de trabajo.							
Me siento cansado cuando me levanto por la mañana y tengo que enfrentar otro día en el trabajo.							
Me siento consumido por mi trabajo.							
Me siento completamente agotado por mi trabajo.							

Q19 Soporte de la Información

Por favor díganos cuanto esta de acuerdo o desacuerdo con lo siguiente (1 = Totalmente en desacuerdo, 2 = En Desacuerdo, 3 = Algo en desacuerdo, 4 = Ni de acuerdo ni en desacuerdo, 5 = Algo de acuerdo, 6 = De acuerdo, 7 = Muy en acuerdo).

	1	2	3	4	5	6	7
Soy capaz de hacer mi trabajo mucho mejor cuando se utiliza TI En Cabina (PeopleNet).							

La TI En cabina Me da información que es muy útil para hacer mi trabajo. Mi trabajo se hace mucho más fácil cuando se utiliza la TI en cabina (PeopleNet). Necesito la información disponible a través de la TI en cabina (PeopleNet) para hacer mi trabajo bien.							

Q20 En la cabina de TI Soporte al Usuario

Por favor díganos cuanto esta de acuerdo o desacuerdo con lo siguiente (1 = Totalmente en desacuerdo, 2 = En Desacuerdo, 3 = Algo en desacuerdo, 4 = Ni de acuerdo ni en desacuerdo, 5 = Algo de acuerdo, 6 = De acuerdo, 7 = Muy en acuerdo).

	1	2	3	4	5	6	7
Las TI en la cabina est bien diseñada para me guiarme en el uso de sus características. Las TI en la cabina me asiste cuando necesito ayuda con sus características. Las TI en la cabina me guía fácilmente al usar sus funciones. Las TI en la cabina está diseñado de una manera que realmente me ayuda a utilizar sus funciones.							

Q21 Soporte de Comunicación

Por favor díganos cuanto esta de acuerdo o desacuerdo con lo siguiente (1 = Totalmente en desacuerdo, 2 = En Desacuerdo, 3 = Algo en desacuerdo, 4 = Ni de acuerdo ni en desacuerdo, 5 = Algo de acuerdo, 6 = De acuerdo, 7 = Muy en acuerdo).

	1	2	3	4	5	6	7
Las TI en la cabina permite a los demás tener acceso a mí.							
Las TI en la cabina me hace accesible a otros.							
El uso de TI en la cabina me permite estar en contacto con los demás.							
TI en la cabina me permite tener acceso a otros.							

Q22 Intención de renunciar al trabajo

¿Qué tan probable es que usted ... (1 = Muy poco probable, 2 = Improbable, 3 = Algo improbable, 4 = Ni Probable ni improbable, 5 = Algo probable, 6 = Probable, 7 = Muy probable). (*: reversed scale)

	1	2	3	4	5	6	7
... considere tomar un trabajo en una empresa diferente si una mejor oportunidad llegara en el año que viene?							
... trabaje con esta empresa cinco años a partir de hoy?*							
... trabaje con esta empresa tres años a partir de hoy?*							
... considere tomar un un trabajo en otra compañía en el año							

que viene?							

Q23 Satisfacción en el trabajo

Por favor díganos cuanto esta de acuerdo o desacuerdo con lo siguiente (1 = Totalmente en desacuerdo, 2 = En Desacuerdo, 3 = Algo en desacuerdo, 4 = Ni de acuerdo ni en desacuerdo, 5 = Algo de acuerdo, 6 = De acuerdo, 7 = Muy en acuerdo).

	1	2	3	4	5	6	7
Mi trabajo en esta compañía es muy agradable.							
Me gusta mucho trabajar en esta empresa.							
Siento un fuerte orgullo entrabajar en esta empresa.							
Estoy muy satisfecho con mi trabajo en esta empresa.							

Q24 Estresante Financiero

Por favor díganos cuanto esta de acuerdo o desacuerdo con lo siguiente (1 = Totalmente en desacuerdo, 2 = En Desacuerdo, 3 = Algo en desacuerdo, 4 = Ni de acuerdo ni en desacuerdo, 5 = Algo de acuerdo, 6 = De acuerdo, 7 = Muy en acuerdo). (*: reversed scale)

	1	2	3	4	5	6	7
Esta empresa paga bien. *							
Puedo hacer buen dinero en esta empresa. *							
El pago de esta empresa es mejor que en las empresas de transporte comparables. *							

Yo vivo cómodamente con mi sueldo trabajando con esta compañía. *							

Appendix B: Flyer for Survey Advertisement

Appendix C: Measurement model results of the IT stress: Inducer-Reducer model

Analyzing the measurement model involves conducting a confirmatory factor analysis (CFA) for all constructs. We assessed the measurement model by examining (1) reliability, (2) convergent validity, and (3) discriminant validity (Gefen, David, Straub & Boudreau 2000).

1. Reliability was assessed using Chronbach's alpha and composite reliability (CR) scores. Table 8 below shows that the CR scores are greater than 0.9, which is higher than the recommended cut-off (0.7).
2. Convergent validity was evaluated by examining individual item loadings of 0.50 or above, CR of 0.70 or above, and average variance extracted (AVE) of 0.50 or above (Gefen, David, Straub & Boudreau 2000; Straub, Boudreau & Gefen 2004). The results in Table 8 demonstrate that all constructs met the 0.70 CR and 0.50 AVE criterions, supporting convergent validity. Table 9 also shows that all items loaded on their constructs and loadings of all items are higher than 0.6, which is higher than the recommended cut-off (0.5).
3. Finally, discriminant validity was assessed in two ways: (i) by showing that no items cross loaded highly on another construct than its own construct (as shown in Table 9), and (ii) by comparing the square root of AVEs from each construct with its correlations with the other constructs as a test of discriminant validity (as shown in the diagonal of Table 10 diagonal). Based on these results, all constructs passed both discriminant validity tests (Gefen, David, Straub & Boudreau 2000; Straub, Boudreau & Gefen 2004).

Table 5 Results of convergent validity tests

	Items	Cronbach's Alpha	Composite Reliability	AVE
IT learning stressor	4	0.920	0.942	0.803
IT Monitoring stressor	4	0.936	0.955	0.841
Informational support	4	0.858	0.907	0.714
Communicational support	4	0.878	0.916	0.732
Educational support	4	0.951	0.965	0.872
Work exhaustion	4	0.862	0.907	0.710
Job satisfaction	4	0.934	0.953	0.834
Turnover intention	4	0.858	0.904	0.703
Age	1	1.000	1.000	1.000
Income	1	1.000	1.000	1.000
Education	1	1.000	1.000	1.000
Amount of IT use	1	1.000	1.000	1.000
Job control	4	0.883	0.919	0.739
Fairness of rewards	4	0.955	0.968	0.882

Table 6 Factor structure matrix of loadings and cross-loadings

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Q19_1	0.873	0.402	0.037	0.063	0.062	0.212	0.081	0.002	0.055	0.061	0.021	0.172	-0.096	-0.017
Q19_2	0.870	0.365	0.025	0.006	0.074	0.177	0.003	0.112	-0.017	0.067	0.056	0.144	-0.068	-0.009
Q19_3	0.925	0.303	-0.018	-0.045	-0.048	0.278	-0.005	0.054	0.065	0.030	0.025	0.136	-0.138	-0.013
Q19_4	0.914	0.334	-0.036	-0.040	-0.104	0.315	-0.069	0.134	0.015	-0.023	0.020	0.022	-0.162	-0.095
Q20_1	0.334	0.865	0.008	-0.049	0.113	0.344	0.020	0.162	0.023	-0.052	-0.068	0.242	0.079	-0.042
Q20_2	0.380	0.944	-0.088	-0.079	0.071	0.358	-0.055	0.167	0.027	-0.011	0.027	0.280	0.006	-0.104
Q20_3	0.341	0.921	-0.052	-0.053	0.135	0.301	-0.083	0.168	0.039	-0.072	0.059	0.225	0.026	-0.085
Q20_4	0.348	0.936	-0.034	-0.100	0.127	0.349	-0.057	0.180	0.011	-0.042	0.012	0.243	0.004	-0.040
Q27_1	-0.051	-0.010	0.869	0.394	0.556	-0.068	0.324	-0.151	-0.053	-0.073	-0.232	0.186	0.239	0.271
Q27_2	-0.005	-0.106	0.904	0.418	0.553	-0.136	0.397	-0.189	-0.046	-0.069	-0.044	0.164	0.279	0.320
Q27_3	0.029	-0.024	0.945	0.436	0.550	-0.060	0.369	-0.207	-0.052	-0.012	-0.070	0.154	0.213	0.268
Q27_4	0.012	0.007	0.624	0.224	0.446	-0.064	0.253	0.056	0.104	-0.059	0.108	0.205	-0.029	0.196
Q29_1	0.009	-0.010	0.283	0.799	0.266	-0.067	0.236	-0.134	0.030	0.088	-0.044	0.216	0.287	0.132

Q29_2	-0.063	-0.071	0.365	0.849	0.454	-0.124	0.329	-0.169	-0.081	0.044	-0.122	0.194	0.390	0.308
Q29_3	0.073	-0.067	0.415	0.920	0.402	-0.093	0.355	-0.308	-0.073	0.139	-0.063	0.265	0.298	0.261
Q29_4	-0.069	-0.107	0.448	0.851	0.508	-0.085	0.293	-0.233	-0.073	0.052	-0.036	0.292	0.234	0.322
Q28_1	-0.066	0.128	0.652	0.487	0.935	-0.144	0.344	-0.206	-0.040	0.062	-0.057	0.264	0.369	0.309
Q28_2	-0.035	0.125	0.566	0.434	0.947	-0.156	0.361	-0.141	-0.043	0.104	-0.001	0.220	0.304	0.335
Q28_3	0.058	0.104	0.534	0.448	0.926	-0.165	0.296	-0.136	0.006	0.052	-0.011	0.254	0.237	0.281
Q28_4	-0.029	0.092	0.574	0.435	0.927	-0.165	0.335	-0.192	-0.064	-0.041	-0.018	0.223	0.264	0.286
Q24_1	0.368	0.298	-0.154	-0.080	-0.215	0.822	-0.252	0.343	0.065	-0.024	0.031	0.071	-0.218	-0.222
Q24_2	0.189	0.172	-0.005	-0.116	-0.063	0.734	-0.155	0.189	-0.144	-0.122	0.015	0.102	-0.180	-0.114
Q24_3	0.193	0.378	-0.091	-0.078	-0.107	0.902	-0.277	0.347	-0.045	-0.136	-0.049	0.163	-0.187	-0.170
Q24_4	0.218	0.371	-0.073	-0.104	-0.173	0.902	-0.195	0.293	-0.112	-0.071	0.033	0.110	-0.151	-0.163
Q33_1	0.002	-0.002	0.371	0.368	0.328	-0.216	0.886	-0.532	-0.145	-0.062	0.029	0.111	0.507	0.662
Q33_2	-0.003	-0.045	0.373	0.360	0.366	-0.256	0.948	-0.616	-0.108	-0.044	0.053	0.089	0.466	0.573
Q33_3	-0.036	-0.054	0.410	0.297	0.330	-0.169	0.902	-0.389	-0.043	-0.058	0.076	0.018	0.356	0.535
Q33_4	0.012	-0.075	0.324	0.279	0.282	-0.320	0.917	-0.506	-0.063	-0.022	0.053	0.013	0.410	0.575
Q32_1	0.169	0.332	-0.064	-0.137	-0.074	0.354	-0.363	0.810	-0.037	-0.060	0.142	0.312	-0.291	-0.366
Q32_2r	-0.001	0.010	-0.218	-0.317	-0.256	0.217	-0.558	0.880	0.146	-0.052	0.080	-0.052	-0.347	-0.430
Q32_3r	-0.021	0.024	-0.235	-0.346	-0.258	0.237	-0.629	0.893	0.125	-0.056	0.110	-0.062	-0.365	-0.444
Q32_4	0.180	0.308	0.006	-0.004	0.019	0.409	-0.308	0.763	-0.027	-0.061	0.063	0.305	-0.298	-0.314
Q7	0.036	0.027	-0.025	-0.064	-0.039	-0.065	-0.102	0.070	1.000	0.073	-0.031	0.007	-0.198	-0.175
Q8	0.029	-0.047	-0.061	0.096	0.048	-0.104	-0.051	-0.067	0.073	1.000	0.032	-0.006	0.103	-0.058
Q9	0.031	0.007	-0.079	-0.080	-0.023	0.007	0.056	0.118	-0.031	0.032	1.000	-0.013	-0.094	-0.004
Q18	0.120	0.271	0.204	0.282	0.256	0.134	0.067	0.130	0.007	-0.006	-0.013	1.000	0.029	-0.011
Q26_1	-0.083	0.049	0.278	0.356	0.424	-0.271	0.497	-0.394	-0.127	0.128	-0.029	0.119	0.876	0.526
Q26_2	-0.123	0.040	0.215	0.337	0.246	-0.168	0.375	-0.345	-0.159	0.080	-0.111	0.029	0.914	0.499
Q26_3	-0.171	-0.017	0.116	0.258	0.203	-0.138	0.429	-0.338	-0.202	0.076	-0.077	-0.041	0.867	0.488
Q26_4	-0.099	0.033	0.145	0.251	0.165	-0.148	0.321	-0.231	-0.222	0.057	-0.134	-0.043	0.776	0.437
Q30_1	-0.042	-0.084	0.244	0.257	0.279	-0.199	0.583	-0.407	-0.103	-0.075	0.041	-0.061	0.561	0.930
Q30_2	-0.059	-0.126	0.289	0.284	0.299	-0.215	0.625	-0.442	-0.168	-0.055	-0.013	-0.023	0.527	0.968
Q30_3	-0.040	-0.088	0.319	0.343	0.359	-0.192	0.626	-0.475	-0.177	-0.046	-0.045	-0.008	0.547	0.958
Q30_4	-0.024	0.026	0.334	0.259	0.279	-0.145	0.581	-0.427	-0.204	-0.042	0.008	0.049	0.507	0.899

Table 7 Inter-construct correlations and average variance extracted (AVEs)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	**.896**													
2	**.383**	**.917**												
3	**0.004**	**0.045**	**.845**											
4	**0.012**	**0.077**	**.446**	**.856**										
5	**0.022**	**.121**	**.624**	**.483**	**.934**									
6	**.286**	**.370**	**0.100**	**0.110**	**0.168**	**.843**								
7	**0.006**	**0.047**	**.404**	**.360**	**.359**	**0.264**	**.913**							
8	**.087**	**.185**	**0.163**	**0.254**	**0.181**	**.353**	**0.567**	**.838**						
9	**.036**	**.027**	**0.025**	**0.064**	**0.039**	**0.065**	**0.102**	**.070**	**1.000**					
10	**.029**	**0.047**	**0.061**	**.096**	**.048**	**0.104**	**0.051**	**0.067**	**.073**	**1.000**				
11	**.031**	**.007**	**0.079**	**0.080**	**0.023**	**.007**	**.056**	**.118**	**0.031**	**.032**	**1.000**			
12	**.120**	**.271**	**.204**	**.282**	**.256**	**.134**	**.067**	**.130**	**.007**	**0.006**	**0.013**	**1.000**		
13	**0.138**	**.031**	**.226**	**.355**	**.317**	**0.217**	**.481**	**0.390**	**0.198**	**.103**	**0.094**	**.029**	**.860**	
14	**0.044**	**0.073**	**.317**	**.306**	**.325**	**0.200**	**.644**	**0.467**	**0.175**	**0.058**	**0.004**	**0.011**	**.570**	**.939**

(Note 1: Column # 1=IT learning stressor, 2=IT Monitoring stressor, 3=Informational support, 4=Communicational support, 5=Educational support, 6=Work exhaustion, 7=Job satisfaction, 8=Turnover intention, 9=Age, 10=Income, 11=Education, 12=IT use experience, 13=Job control, 14=Fairness of rewards.

Note 2: Figures in the shaded diagonal are the square roots of the AVEs)