The role of the law enforcement agencies in transport security, a survey with Swedish operators

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Abstract Transport security, that is, the protection against antagonistic attacks in form of terrorism, theft, counterfeiting, piracy etc. has become a major concern for managers during the last years. The consequences of security incidents include economic losses for industries, but in case of terror attacks may also affect society in general. If transport networks are not adequately protected, consumable products (e.g. food, pharmaceuticals) could be counterfeited or contaminated and smuggled into a country, giving rise to death or diseases. Today, to enhance the protection of transport networks, companies have wide access to handbooks, advanced security technologies or certification programs (e.g. TAPA EMEA, ISO28001, C-TPAT or AEO, etc.). Despite this, statistics indicate that transport networks are low-risk/high-revenue targets, and therefore security needs to be enhanced. The purpose of this paper is to highlight the role played by the law enforcement agencies in transport security. More specifically, this paper strives to demonstrate the influence of the allocation of law enforcement agencies' resources on criminal justice efforts as well as on community policing activities to deter crime. Using Structural Equation Modelling techniques, two hypotheses are empirically tested on a sample of 577 Swedish transport operators. The results unveil that both the relationships are statistically significant. Finally, implications for managers and practitioners are discussed.

Keywords Logistics security · Supply chain security · Law enforcement agency · Transport security · Community policing · Criminal justice efforts

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1 Introduction

Supply chains are expected to perform in accordance to European laws, for example, freedom of competition, immunity of assets, copyright protection, safety of transport operators and managers etc. However, available statistics give indication that very often the supply chain business is a constant victim of actions perpetrated by organized crime as for instance, fraud, theft, corruption, violence etc. [26, 46]. These incidents are not often publicly reported by firms because of the negative effects they may have on the brand image of the organizations involved [18]. However, the magnitude of their frequency is so high and the related consequences so severe that many supply chain firms have indicated "security" as one of their management's top priorities to work on within the next years [41].

It has been demonstrated, in many contexts, that the insecurity of supply chains has severe consequences for business and society. Existing figures, which do not take into account the disruptive effect of failed deliveries in

supply chains, show amounts of stolen cargo in US between $10 and $30 billion and in Europe at about €8.2 billion [2, 21]. It has also been estimated that in Europe alone, $176 billion of goods have been counterfeited in 2005 [34]. However, costs of security incidents may be related to disruption costs and therefore to shipment delays, lost sales and unsatisfied customer demand [1, 13, 47]. For instance, in case of theft, a disruption will be originated because the goods disappear while in transit and will not be delivered on time to the consignee. Delays or losses may be also experienced in case suspicious elements (e.g. counterfeits or contraband) are detected by Customs officers; hence, containers could be stopped, inspected and eventually seized. Finally, other costs of security incidents include the following[25]: increased insurance premiums, enhanced security protection, internal audit activities, investigation and prosecution of suspects, increased selling prices and weakened competitive advantage, business reputation, deterioration in quality of service, threat to the survival of the business etc.

A worrying aspect of the insecurity of supply chains concerns the possible societal repercussions. Direct consequences may concern the safety of operators and our communities. During an attack to a terminal or transport vessel, drivers or terminal operators may be killed, threatened or severely injured [28]. Terrorists may manage to contaminate food, pharmaceutical, disrupt critical supplies or even smuggle weapons or terrorists and thereby expose societies to terror attacks, (e.g. causing fear, injuries, death, environmental contamination etc.) [39]. Indirect consequences include the fortification of criminal organizations that are able to make their revenues grow while encountering minimal penalties. As criminology experts indicate "the real harm done by organized crime comes not from selling inherently illegal goods and services but from the way the profits are subsequently invested" [32]. It has been demonstrated that when criminals enter the legal business, public sector corruption increases so as unfair business competition, a clear damage to society and economic growth of a country [31].

Looking at previous research dealing with supply chain or logistics security, it is possible to deduce that security is an important source of risk to be considered by transport and risk managers [39]. Supply chain risk management researchers recommend identifying drivers of risks in supply chains, in order to optimize risk mitigation strategies and consequently moderate the negative outcomes of disruptions [51]. In addition, more attention should be put to understand what is driving managers' efforts to manage risks [42]. To our knowledge, very little has been done on this topic. Other literature from criminology has investigated the nature and extent of business crime and more precisely the interaction between the business and the law

enforcement agencies. In particular, it is pointed out that the business may manage to more effectively and proactively deal with crime through closer collaboration with the Law Enforcement Agencies (LEAs) [6, 7]. In these studies very little focus is given on the supply chain business. At the same time, other research in the supply chain management area have pointed out that the interaction of supply chain companies with authorities as customs administrations may influence security (e.g. security certifications) [12, 14, 22, 48, 50]; however, none of them undertake an empirical analysis to understand the role of LEAs in supply chains.

Hence, the purpose of this article is to explore the role of law enforcement agencies in supply chains. In particular, by means of interviews and a survey study performed in Sweden, we aim to understand how the transport sector evaluates the efforts that the law enforcement agencies are putting to deter security incidents.

This article is split into 8 sections: after the introduction the following two sections expound the theoretical framework and the research hypotheses to be tested in this study. The fourth section describes the methodological steps to perform the explorative study and the survey study. Next, the results of the interviews and the survey including descriptive statistics, factor and confirmatory analysis and hypotheses testing are discussed in section five and six. While section seven discusses the results, section eight presents the conclusions from our study as well as implications for managers and practitioners.

2 Theoretical framework

As part of the theoretical framework, we summarize previous research, relevant for this paper, within the topics of transport security, protection and defence and the role of law enforcement agencies.

2.1 Transport security

In this paper, transport security threats are interpreted as crime events that are perpetrated from individuals outside or inside transport companies, that is, antagonistic attacks. Antagonistic attacks have been widely studied within the criminology discipline and only recently have come to the attention of transport and supply chain researchers. Present research has pointed out the correspondence between criminology theories and transport/supply chain security [19]. According to the elements of crime theory, a crime against a supply chain is committed whenever three elements converge: (1) the perpetrator, (2) the target and (3) lack of proper security. In addition, the crime displacement theory states that

criminals make rational choices depending on a subjective estimation of the profits and efforts required to commit the crime (i.e. the level of protection of the targets and prosecution risks). Very often, supply chains are targeted by criminals as the result of a rational decision based mainly on two parameters: the expected profits compared with the risks of the venture [37]. For instance, when goods are stolen from cargo transported in supply chains, criminals evaluate the value of the goods when resold on the black market, compared with the level of vulnerability of cargo and also the efforts that the police will put to deter their actions and prosecute them once arrested [19]. A consequence of this behaviour is that criminals are likely to attack the weakest links of supply chains [9, 38, 52]. For instance, statistics tell that the securing of terminals causes the increment of incidents during transport or in parking places [19].

2.2 Protection & defence

The need for security during transport is to prevent the loss of the cargo as well as unwanted negative disruption in the flow of goods [39]. Security may be enhanced by means of the combination of preventive measures and human and material resources intended to protect transport infrastructure, vehicles, systems and workers against intentional unlawful acts [20]. In [45], physical transport security is categorized as a combination of measures for preventing, detecting and recovering a supply chain.

To support companies willing to protect their assets diverse security certifications have been developed. Examples are the authorities' certifications as the C-TPAT (Customs-Trade Partnership Against Terrorism) in US or the AEO (Authorized Economic Operator) in Europe or business certifications issued by TAPA (Transported Assets Protection Association) [9, 36, 38, 39, 52].

2.3 Role of law enforcement agencies

Criminologists have widely explored the problem of business victimization, including the role of law enforcement agencies and the factors influencing crime. Business victimization concerns the victims' perceptions about how the business should be operated in crime-free conditions and in particular, how the interaction with the law enforcement agencies (LEAs) results into higher protection [44]. Existing literature highlights three effective practices that the LEAs may undertake to protect business: community policing activities, criminal justice efforts and allocation of resources.

2.3.1 Community policing activities

The traditional approach that the police use to prevent and control crime is based on reactive tactics as random patrolling, rapid response to emergency calls and retrospective criminal investigations [31]. However, existing research has pointed out that better crime deterrence may be achieved by means of *community policing*. Sherman [40] indicates that paradoxically ''motorized police patrol is a process of merely waiting to respond to crime''. Hence, the process of moving police officers out of patrol cars opens the possibilities to establish a direct contact with people and by that enhance the knowledge of the crime problems and ultimately improve crime prevention [43]. Reactive tactics fail to proactively prevent crime as they keep police distant from the community. This implies that no relationships can be established with people and businesses and consequently the police work to prevent and respond to crime is biased [31]. Hence, criminology researchers claim that more capital and efforts should be allocated on proactive strategies to deter crimes [6, 7]. Examples of these strategies may include the usage of informants, covert surveillance and also partnerships with the victims [31]. In particular, by establishing closer relationships with the community, the police may enhance its capability to (1) diagnose and manage problems, (2) facilitate crime solving and (3) build self-defence capabilities within the community itself [31].

2.3.2 Criminal justice efforts

Arrests and prosecution of criminals seem to have a deterring effect on crime [8]. This reasoning naturally follows the theory of rational choice, according to which, criminals trade off the expected profits with the risks. If the risks overweigh the profits, then criminals may decide to not commit the crime. Previous research, by means of econometric cross-section techniques, has demonstrated that probability of arrest, conviction and punishment (e.g. fines, probation and imprisonment) may negatively affect crime rates [11]. Becker [5] proves that optimal allocation of criminal justice resources may effectively combat and discourage illegal behaviour [5]. Finally, it is important to point out that allocating police and criminal justice, resources should focus on policing actions, corrective services and finally administration of justice functions [7].

2.3.3 Allocation of resources

The amount of resources allocated by the police is usually based on statistics, i.e. the numbers of crimes reported or recorded by the police. The relationship is simple and naïve at the same time, if crime rates are low, then police budgets

and resources allocation decline [30]. Criticism has been put forward against this approach, since low incidence of crime within a region could be the result of other factors: for instance, higher resource allocation, the socio-economic characteristics of the area of interest or even the consequence of the on-going victimization of the business, that is the low trust and confidence that the business sector has towards the police, causing a reduction in reporting. If this is the case, the data could mask an even more serious problem, where the business has somehow accepted to tolerate and deal with the criminals [7]. This was the case of East European countries in which public mistrust of police and gross misrepresentation of the true crime level were affecting the low levels of recorded crime [49].

3 Research hypotheses

Allocating resources is fundamental to ensure that governments are capable to deter transport crime, but also to promptly arrest and prosecute criminals. Tulyakov [44] sustains that the inefficacy of state law enforcement agencies favours the criminal organizations that reside in that country and indirectly bring economic losses to the business. Diverse studies have demonstrated that increasing police resources may lead to improved crime deterrence, arrest and prosecution [2, 4, 6]. However, it is highlighted that to ensure its deterrent effects, resources have to be used for community policing activities, so not only patrolling and waiting to respond methods, but also to establish a direct contact with the community to enhance the understanding of the crime problem and to identify the solutions to adopt. Hence, by applying these theories to the transport crime problem, our research hypotheses are the following:

H1   The scarce resource allocation of law enforcement agencies affects criminal justice efforts to deter cargo crime

H2   The scarce resource allocation of law enforcement agencies affects the community policing activities driven to improve transport security
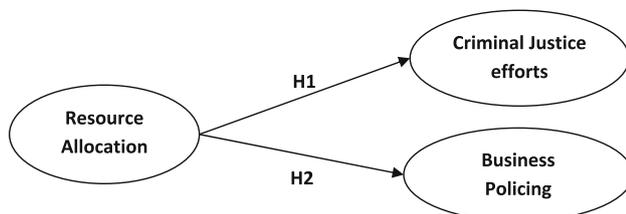

Fig. 1 Proposed model about the impact of resource allocation on criminal justice efforts and community policing

Figure 1 provides the conceptual model derived from theory.

4 Methodology

The methodology is mainly based on an explorative study followed by a survey. Thus, the whole investigation is based upon a combination of qualitative and quantitative methods which is a recommended approach within logistics research [16, 33]. Qualitative unstructured and semi-structured interviews as well as observations were exploited to gather data concerning the factors influencing the efforts made by firms to enhance transport security. More specifically, a total of 16 interviews (4 unstructured and 12 semi-structured) with key actors in the transport security area were performed. The demographic characteristics of the interviewed managers as well as the scheme for the interviews performed are provided in the Appendix of this paper. After 12 interviews, data saturation occurred. Hence, four additional interviews were performed at a later phase to ensure not only data saturation, but also the stability of the data over time [17, 23]. Patterns and themes were identified within the transcribed texts of previous literature, observations and interviews (*ibid*). Finally, by means of a systematic process, the hypotheses concerning the role of the law enforcement agency were formulated.

4.1 Instrument

After the explorative study, a first draft of the survey was prepared and submitted to three academics and one Swedish language expert to enhance clarity. Based on the feedbacks, the questionnaire was modified, and some questions rephrased, added or deleted. The new questionnaire was submitted to a group of 10 Swedish industrial professionals for a pre-test. This was necessary in order to improve the wording and format of questions, enhance comprehension, make the questions easier to answer and finally ensure that the items in the sets of questions well represented the constructs. In addition, to ensure the validity of questionnaire, all the questions referred to data from 2009. Hence, data that are not too far in the past and that may be easily accessible by the respondents [27]. The final version of the questionnaire was composed of 10 areas of questions, of which two are of concern for this investigation: the demographic characteristics of the respondents and the sets of questions concerning the perception of prosecution, resource allocation and collaboration activities performed by law enforcement agencies. The items representing these three constructs were measured on five-point

Likert scales from *1—Strongly Disagree* to *5—Strongly Agree*, with a neutral alternative in the middle.

4.2 Measures

The construct concerning the resources allocated by the law enforcement agency was based on a set of six questions. According to the collected empirical data, transportation companies experience the allocation of resources as fundamental to combat cargo crime. Findings from the interviews and observations tell that the law enforcement agency is not allocating enough resources mostly because security incidents are not often reported by operators. So, this set of questions aims to measure the resource allocation construct from three viewpoints: the first concerns the measurement of the magnitude of resource allocation; the second is the frequency of security incidents reporting; and finally the third aims to measure a combination of the two, high reporting frequency causes higher resource allocation (Table 1).

The construct concerning the criminal justice efforts is also measured by means of a set of six questions. The purpose of these questions is to measure the perception of the work done by the criminal justice system to prosecute criminals in terms of punishment degree and time to process and keep the cargo criminals in custody (Table 2).

Table 1 Questions to measure the construct of resource allocation

Construct	Questions
Resource allocation	Cargo security frequency reporting to law enforcement
	Law enforcement resource allocation is very good
	Law enforcement allocate enough resources to combat cargo crime
	Cargo security reporting increases law enforcement efforts
	Cargo security reporting has high priority
	High cargo security reporting causes higher resource allocation

Table 2 Questions to measure the construct of Criminal justice efforts

Construct	Questions
Criminal justice efforts	Effort of justice to punish criminals
	Penalty sentence
	Quick arrest and process in court
	Increased confidence for law enforcement's efforts
	Criminals' return to target
	Rigid criminal's punishment

Table 3 Questions to measure the construct of collaboration

Construct	Questions
Business policing	Frequency of attendance to policing activities
	Security activities enhance security
	Self-defence capabilities are improved by joining security activities
	Policing activities improve collaboration among stakeholders
	Importance for establishing a relationship with law enforcement agency
	Stronger relationship with law enforcement agency improve security

Finally, six more questions have been developed to measure how firms perceive the business policing activities carried out by the law enforcement agency. Questions included the participation frequency to the activities organized by the law enforcement agency, the stimulation perceived to increase security as well as the improvements to prevent and recover operations after cargo security incidents (Table 3).

4.3 Respondents

The transportation companies included in the sampling frame were extracted from the Swedish Business Register database. A first examination of the database revealed that 28,250 firms were registered in Sweden in the beginning of 2010. To limit the number of companies to be surveyed as well as to enhance the comprehension of the questions, it was decided to exclude two categories: support activities and management of terminals and infrastructure. The resulting population corresponds to a total of $N = 14,801$ companies divided into seven different groups: freight rail transportation, freight road transportation, freight water transportation, freight air transportation, other postal activities, courier activities and newspapers distribution. The optimal sample size to be surveyed was calculated by exploiting Cochran's formula with 95 % confidence level and $p = 50$ %, the sample size was put in relation with confidence intervals from ± 0 % to ± 10 % [10]. Hence, the survey was sent to 577 companies that were chosen among the groups by means of stratification. 200 companies were proportionally counted in each stratum and randomly extracted from the database. Thereafter, the remaining 377 companies were selected by including all the medium and large companies and by randomly choosing further small companies.

4.4 Data collection

The data collection was performed between April and June 2010. The survey questionnaire along with a two page

Table 4 Demographic data

	Number of employees			Responses	Sample	Population
	0–49	50–250	>250			
Freight rail transport	1	4	2	7	7	21
Freight road transportation	386	142	5	181	533	14064
Freight water transportation	8	4	0	5	12	283
Freight air transportation	1	2	0	3	3	29
Other postal activities	1	0	2	3	3	47
Courier activities	9	0	1	2	10	341
Newspaper distribution	0	1	8	2	9	16
Responses	133	62	6			
Sample	406	153	18			
Population	14630	153	18			

cover letter and a prepaid postage return envelope were mailed to the security, risk, transportation and logistics managers of the selected companies. To respect the anonymity of the answers, a unique code was generated, assigned to the respondents and printed on the return envelopes. This was also necessary to keep track of the responses and limit the postage of reminders [15].

To increase the response rate, the cover letter (1) included the logo of the Swedish police, (2) included a detailed description about how to compile the questionnaire, (3) ensured the confidentiality of the answers and (4) promised an executive summary of the results. Reminder letters, together with a copy of the questionnaire and a prepaid postage return envelope were sent to non-respondents 2 weeks after the deadline. In addition, follow-up telephone calls were performed (1) to enhance the quality of the answers and (2) to obtain additional responses [15]. A total of 47 companies were contacted by phone during this process. The reasons for not answering the questionnaire were in order, lack of time, internal policy, difficult to find the right competence, not relevant (this was especially true for recycling and low value goods companies). In only one case, a manager could not access data from 2009 because she was recently unemployed. Finally, in other cases, the company had bankrupted or was sold. At the end of the data collection, a total of 210 questionnaires were received which corresponds to a response rate of about 36.4 %. By performing a missing value analysis, it was decided to keep only the questionnaires with less than 17 missing answers. This implies that 35 questionnaires were removed from the sample for subsequent data analysis. The demographic characteristics of the sample are reported in Table 4, together with information about the population and sample size in each of the strata, as well as the amount of responses.

4.5 Data analysis

The statistical methods used in this investigation are based on multivariate analysis techniques. The general structure of the statistical analysis to be performed includes the following steps: descriptive statistics, exploratory and confirmatory factor analysis and structural equation modelling. Before running the analysis, the presence of common method bias was checked by performing an un-rotated factor analysis using Kaiser Criterion (Eigen value > 1). This analysis revealed the existence of 18 distinct factors that accounted for 75.3 % of the variance. In particular, it was noticed that the first factor accounted for only 27.9 % of the variance. Hence, since a single factor did not appear in the analysis as well as the first factor did not account for the most of the variance, the absence of common method bias may be assumed [35]. In addition, in this investigation, one-tailed tests are used and the level of significance has been set to <0.05. All the statistical analyses have been carried out with SPSS v. 15.0 and LISREL 8.80.

4.5.1 Descriptive statistics

In this phase, the following analysis was performed: missing value analysis and calculation of numerical summary measures as means and standard deviations.

4.5.2 Exploratory and confirmatory factor analysis (EFA and CFA)

By performing an exploratory factor analysis (EFA), the questions in the survey have been put together in summated scales [24]. The EFA performed within this investigation is based on a principal component analysis (PCA) with orthogonal rotation (Varimax). The correlation coefficients

as well as the determinant of the correlation matrix have been screened to detect multicollinearity problems and avoid biases in the reduced data [24]. The adequacy of the sample size as well as the magnitude of correlations between the items (necessary conditions for PCA) is assessed, respectively, with the Kaiser–Meyer–Olkin (KMO) measure and the Bartlett's test of sphericity [24]. Finally, the reliability degree of the related constructs has been checked by performing a reliability analysis and by consequently examining the values of the Chronbach's alpha [24].

A confirmatory factor analysis (CFA) has been run to determine how well the measured variables represented the constructs. This technique is different from the EFA since the number of constructs, as well as the relationships between the items and the constructs are established by the researcher [24]. The analysis of the model fit indices was exploited to establish construct validity and unidimensionality. Convergent validity was assessed by examining the value of standardized coefficients, t values for the individual paths, construct reliability (CR) and average variance extracted (AVE) [24]. Discriminant validity was estimated by developing additional measurement models in which the correlation of any two constructs under examination was set to 1.0. Thereafter, differences of the χ^2 values for the fixed and free solutions were examined to assess the distinctiveness of the two constructs [24].

4.5.3 Hypothesis testing

The hypothesized structural equation model illustrated in Fig. 1 was tested using LISREL 8.80. The model used the resource allocation construct as the exogenous variable and the *criminal justice efforts* and *business policing* constructs as the endogenous variables. The model parameters were estimated using the method of maximum likelihood, which is set as default in the software [29]. Within this stage, the values of model fit indices were checked to validate whether the model fits the data, and significance was determined by examining the t test values at $p < 0.05$ level.

4.6 Validity and reliability

To ensure the validity of the questionnaire, the survey indicators used to measure the theoretical constructs were scrutinized by academics. The data collected refer to 2009, that is, believed not to be too far in the past and therefore easily accessible by respondents. Moreover, the survey was targeted at individuals that possessed the right competence and experience to provide with credible and accurate answers. Finally, to enhance the validity of this investigation, the developed survey instrument was thoroughly pretested using numerous academic professionals

(supervisors and other colleagues), 1 language expert and 1 administration officer. Additionally, the instrument was also pretested using 10 professional experts working in the field of transportation and logistics security. Comments and feedbacks from these two reviews have been used to enhance the accuracy of the questions.

In this investigation, internal consistency has been checked by means of a factor analysis as well as by calculating and reporting the Cronbach's α. The reliability of this survey has also been measured by using the extrapolation method, which is built upon the assumption that respondents answering less readily are more like non-respondents [3]. Hence, in this investigation, by comparing early and late responses, no significant differences were found, either in terms of the outcome variables nor in terms of the demographic characteristics, which indicates the absence of non-response bias [3].

5 Interview results

The relevance of the law enforcement agency to prevent as well to support operators in recovering their shipments was teased out during two security workshops held in Sweden.[1] During these events, police representatives encouraged transport companies to report cargo theft and improve collaboration with the law enforcement agency.

One of the main findings during the workshop was that the resources allocated by the Swedish law enforcement agency are scarce and consequently the deterrent effect on crime is minimal. In particular, the participants criticized the law enforcement agency since they often do not prioritize cargo theft. According to three of the respondents, the problem faced today is that the amount of received theft claims from transport operators is not high enough to justify an increment of resources to combat criminals. Transport operators are afraid to show their brands in theft statistics. In addition, they feel that this is only an administrative cost that will rarely lead to cargo recovery.

> Transport operators are afraid to show their brand names in theft statistics and therefore they do not announce the problem to the police that in its turn does not have the real picture of the situation.

> Operators are not claiming enough, thus we cannot allocate resources adequately.

> Our company has a good cooperation with the national law enforcement agency. However, we know

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[1] Insurance company seminar, Gothenburg, Sweden, March 2008. Workshop on Transportation Security, Jönköping, Sweden, November 2007.

that many thefts are not reported by other companies. This makes it hard to combat cargo theft.

Other results from the interviews indicate that operators perceive existing laws to prosecute criminals as too weak. As a consequence, it is not only difficult to arrest criminals, but also to keep them in custody.

> Criminals attack according to a trade-off between risks and revenues. The situation today is that distribution chains are easy and profitable targets. At the same time, prosecution is not severe enough to discourage perpetrators.

> Once criminals are captured, we can keep them in custody for a limited amount of time. So they are back in business after only few months.

> Prosecution should be more severe to discourage criminals attacking our distribution chains.

Finally, two respondents also say that to reduce the increase in cargo theft experienced during recent years, the Swedish law enforcement agency is today working with policing activities to increase awareness about the cargo security problem.

> The activities organized by the law enforcement agency have contributed to increase awareness of the cargo theft problem

> Thanks to the workshops, we have had the possibility to come closer to the law enforcement agency and strengthen collaboration

6 Survey results

The data collected is analysed using four steps. First, the descriptive statistics of the items used to measure the constructs is reported. Next, results from EFA and CFA are reported in order (1) to identify underlying dimensions behind the variables used in the four areas of questions and (2) to measure how well the items identified in the EFA measure the constructs. Finally, the hypothesized structural model in Fig. 1 is tested.

6.1 Descriptive statistics

The patterns of the indicators used to measure the factors influencing security were also inspected. All the variables' scores range between 2, *Disagree* and about 3.27, (3 *Neither Agree nor Disagree*) (Table 5). However, 16 of the 18 variables used are below 3. The variables that score lowest are those concerning the frequency to join community policing activities ($M = 2.5$; SD = 1.15) and the severity

Table 5 Summary of variables measuring the influence of law enforcement agency ($N = 175$)

	Mean	SD
Effort of justice to punish criminals	2.63	0.95
Penalty sentence	2.74	1.08
Quick arrest and process in court	2.64	1.14
Increased confidence for law enforcement's efforts	2.94	1.06
Criminals' return to target	2.79	1.05
Rigid criminals punishment	2.56	1.09
High security reporting frequency	3.27	1.11
Efforts to arrest criminals	2.84	1.05
Law enforcements' resource allocation	2.72	1.13
Confidence for prosecution after reporting	2.98	1.07
Security reporting highest priority	3.18	1.10
Reporting incidents increase police's resource allocation	2.94	1.05
Always joined security activities	2.50	1.15
Security activities enhance security	2.66	1.19
Security knowledge is improved by joining security activities	2.82	1.24
Security activities improve collaboration among stakeholders	2.75	1.20
Importance of collaboration with law enforcement agency	2.91	1.26
Collaboration with law enforcement agency improve security	2.79	1.17

of criminal punishment ($M = 2.56$, SD = 1.09). The variables with the highest scores are the frequency to report security incidents ($M = 3.27$, SD = 1.11) as well as the high priority given by organizations to report security incidents ($M = 3.18$, SD = 1.10).

6.2 Factor and reliability analysis

A PCA with Varimax rotation was performed to identify different dimensions in the variables used to measure the influence of the law enforcement agency. The correlation coefficients suggest that multicollinearity is not an issue. The Kaiser–Meyer–Olkin measure (KMO = 0.90, marvellous according to Kaiser, 1974) indicates the suitability of the sample size for the factor analysis.

The Bartlett's test of sphericity is significantly large ($\chi^2(153) = 2581.3$, $p < 0.01$) which implies that the correlation matrix is not an identity matrix (the correlations between items were sufficiently large). Examining the scree plot, and following the Kaiser's criterion, a total of three factors explaining 72.3 % of the variance were extracted. The interpretation of the variables clustered in the rotated component matrix (Table 9), results in the following factors:

- Component 1. Criminal justice efforts (CJE).
- Component 2. Community policing activities (CPA).
- Component 3. Resource allocation (RA).

Table 9 also presents the items' communalities after extraction as well as the Cronbach's alpha of the three components. The majority of the items have communalities greater than 0.7. In addition, the average communality is 0.72 which confirms the correct adoption of the Kaiser's criterion. The Cronbach's alphas of the three factors were all above 0.8 which verifies the high reliability of the scales identified with the factor analysis.

Confirmatory factor analysis (CFA) was run to further establish unidimensionality and construct validity. The values for the fit indices show that the model fits the data sufficiently well (NNFI = 0.94, CFI = 0.96, root mean square residual [RMSR] = 0.08, root mean square error of approximation [RMSEA] = 0.1 and χ^2[NC] = 3.44).

Confirmatory factor analysis was also used to assess discriminant validity. Significant differences of the χ^2 values for the fixed and free solutions testify the distinctiveness of the constructs (Table 6). In addition, the examination of the confidence intervals that was set to be equal to plus or minus two standard errors of the correlation coefficient of the pair of constructs, do not include the value of 1. Hence, discriminant validity was ensured.

Table 6 Assessment of discriminant validity

	CJE	RA	CPA
Criminal justice efforts	–		
Resource allocation	162.32	–	
	0.79–0.90		
Community policing activities	1144.17	499.38	–
	0.26–0.51	0.36–0.59	

First row χ^2 differences between the fixed and free solution [significant at $p < 0.01$ (1 df)]

Second row confidence interval (none of them include 1.00)

Table 7 Indirect and total effects

Exogenous variable	Endogenous variables	
	Criminal justice efforts (CJE) Total	Community policing activities (CPA) Total
Resource allocation (RA)	0.83* (0.19)	0.47* (0.78)

* t values significant at $p \leq 0.01$

6.3 Hypotheses testing

As indicated earlier, the hypothesized structural model was tested using LISREL. In particular, given the satisfactory measurement results, the summated scores were used to measure the model's latent constructs. The model parameters were estimated using the method of maximum likelihood. The values for the model fit indices indicate that the model fits the data sufficiently well (NNFI = 0.95, CFI = 0.96, root mean square residual [RMSR] = 0.07, root mean square error of approximation [RMSEA] = 0.1 and χ^2[NC] = 2.76). The t tests show that both of the two hypothesized relationships were found to be significant at 0.01 level (Table 9). More specifically, the path from resource allocation to prosecution degree is statistically significant ($b = 0.19$; $t = 4.42$; $p < 0.01$). Likewise, the path from resource allocation to collaboration activities is also significant ($b = 0.78$, $t = 7.29$, $p < 0.01$). Total effects of the model are reported in Table 7.

7 Discussion

The data analysed in this paper (both from the interview and the survey studies) recognize the important role of the law enforcement agencies in transport security. Our results are in line with theories from criminology that claim the importance of allocating more resources to community policing and the criminal justice system to more effectively deter business crime. In this paper, we test these theories in the context of transport security, that is, theft crime perpetrated against cargo moving in supply chains and demonstrate that Swedish transport companies perceive the following:

(1) The increment of resources allocated by the law enforcement agencies improves the efforts put by criminal justice to prosecute criminals (H1).

(2) The increment of resources allocated by law enforcement agencies results in improved community policing activities (H2).

Our results show that in Sweden, the resource allocation of law enforcement agencies is generating results in terms of better prosecution and relationship with the transport industry. However, it is important to notice that the descriptive statistics of the data shows that many of the variables (16 of 18) used in the questionnaire scored below 3 (*neither agree nor disagree*). This implies that despite the positive relationships between the survey's parameters, transport companies are not fully satisfied with the current levels of allocated resources, the on-going community policing activities and criminal justice efforts.

As a consequence, we claim that more resources should be allocated to deter cargo crime in Sweden. In particular, these resources should aim to stimulate transport companies joining policing activities, facilitate crime reporting, streamline procedures to arrest and quickly prosecute criminals, and to review the legal system especially in terms of punishments for crimes in this area. It has been demonstrated that in countries where law enforcement agencies are weak, the business sector may lose confidence in the authorities. The major risk is that discouraged companies stop reporting crime which can lead to a dangerous cycle, that is, the reduction in crime reporting may lead to a reduction in resources to deter crime and prosecute criminals.

Hence, if immediate changes are not implemented, then cargo crime may substantially increase, resulting in potentially considerable financial losses for the transport industry. Furthermore, this may have a negative impact on the economic growth of a country, especially considering the fact that the majority of transport companies are small/medium-sized enterprises and the risk of them going bankrupt, with just few incidents, is quite high. Another consequence is that companies may consider security losses as part of *the costs for doing business*. Accordingly, they might start to make extended usage of strategies to absorb losses internally, for example, insurances and risk sharing in contracts' clauses. While the transport companies might find ways to cover the losses, organized crime may see this as an opportunity to increase their activities in the transport industry. Obviously, this is not an acceptable scenario, and thus actions are required—especially given the potentially negative societal consequences.

8 Conclusion

In this paper, we combine explorative investigation along with survey-based study to understand the importance of the role of law enforcement agencies in transport security. Theories from criminology are used to develop two main hypotheses concerning the relationship between the resources allocated by the law enforcement agency and (1) the community policing activities and (2) the criminal justice efforts. To test these hypotheses, a questionnaire was developed and sent to 577 physical distribution carriers operating in Sweden. The survey had a final response rate of 36.4 % (210 questionnaires).

Examining the arithmetic average of all the items used to measure the three constructs, it is possible to depict a generic dissatisfaction towards the work that is being done by the law enforcement agency ($M = 2.82$, $SD = 1.1$). Also, looking at the averages of the constructs used in the analysis, it may be stated that the respondents seem (1) to not properly be satisfied with the criminal justice efforts to prosecute criminals, (2) to not to be convinced that the law enforcement is allocating enough resources to fight cargo crime and (3) to not properly join policing activities.

The application of Structural Equation Modelling techniques confirms the high impact of resource allocation on criminal justice efforts, that is, the proper prosecution of cargo crime. Accordingly, if resources are adequately allocated by the law enforcement agencies, then criminals would be properly prosecuted and most of all cargo crime deterred. Additionally, our results show that the allocation of resources made by the law enforcement agencies positively affects the policing activities to help transport companies protecting their assets.

From a scientific viewpoint, this investigation contributes to existing literature by showcasing the importance of the role of the law enforcement agencies in transport security. From a practical viewpoint, transport and logistics managers are recommended to strengthen their relationship with the police especially in terms of correct and promptly performed crime reporting. Otherwise the risk is that the law enforcement agencies will not be able to allocate resources to fight cargo criminals and play a key role in (1) deterring attacks, (2) prosecuting organized crime, and finally (3) organizing policing activities.

In the remainder of the section, we present some key limitations with the ambition of providing potential avenues for future research. The first limitation concerns the measures developed for the three constructs: resource allocation, community policing activities and criminal justice efforts. Given that these are newly developed scales, future research needs to validate the indicators used in this investigation and also develop robust indicators to measure these constructs. Second, the results of this investigation may be generalized only to the transportation sector in Sweden (according to [10] with a confidence level between ±7 % and ±8 %).To extend the external validity of the findings from this study, we recommend future research to replicate this study using samples from other countries.

Appendix

See Tables 8 and 9.

Table 8 Demographic characteristics of the respondents

	Industry	Position
Respondent 1	Electronics Manufacturer	Security Manager
Respondent 2	Transportation	Lawyer
Respondent 3	Road Carrier	Security Manager
Respondent 4	Logistics Service Provider	Global Security Manager
Respondent 5	Food Products	Security Manager
Respondent 6	Pharmaceutical	Security Manager
Respondent 7	Cash Transportation	Security Manager
Respondent 8	Law Enforcement Agency	Police Inspector
Respondent 9	Security Certification	International Sales Manager
Respondent 10	Logistics Service Providers	Regional Security Manager
Respondent 11	Security Solution Provider	Commercial Director
Respondent 12	Road Carrier	CEO
Respondent 13	Security Solution Provider	CEO
Respondent 14	Shipping Company	Senior Director
Respondent 15	Shipping Company	Corporate Security Manager
Respondent 16	Insurance Company	Claims Manager

Table 9 Summary of EFA and SEM fit indices ($N = 175$)

Item	Component				Measurement model	
	CJE	RA	CPA	Communality	Std. Coefficient	t value
Effort of Justice to punish criminals	**0.87**	0.16	0.13	0.79	0.8	13.49
Quick arrest and process in court	**0.81**	0.13	0.22	0.73	0.77	10.61
Rigid criminals punishment	**0.81**	0.12	0.29	0.75	0.94	13.1
Slow criminals' return to target	**0.78**	0.15	0.24	0.69	0.83	11.97
Penalty sentence	**0.73**	0.15	0.17	0.58	0.84	12.57
Increased confidence for law enforcement's efforts	**0.71**	0.19	0.35	0.66	0.93	13.88
Law enforcements' resource allocation	**0.64**	0.17	0.48	0.68	0.84	11.95
Efforts of law enforcement agency to arrest criminals	**0.58**	0.19	0.56	0.69	0.78	10.34
Security Knowledge is improved by joining security activities	0.13	**0.91**	0.16	0.88	0.62	7.64
Security activities enhance security	0.12	**0.90**	0.15	0.84	0.87	13.13
Security activities improve collaboration among stakeholders	0.25	**0.85**	0.09	0.79	0.92	12.89
Importance of collaboration with law enforcement agency	0.00	**0.85**	0.17	0.75	0.84	12.26
Always joined security activities	0.20	**0.84**	0.03	0.75	0.97	13.62
Collaboration with law enforcement agency improve security	0.22	**0.82**	0.10	0.74	1.09	15.79
Security reporting highest priority	0.29	0.15	**0.77**	0.70	1.17	16.49
High security reporting frequency	0.17	0.02	**0.77**	0.62	1.03	14.11
Confidence for proper prosecution after reporting	0.41	0.18	**0.71**	0.71	1.00	12.43
Reporting incidents increase police's resource allocation	0.43	0.38	**0.59**	0.67	0.93	12.48
Eigenvalues	5.10	4.86	3.04			
% of variance	28.37	27.03	16.9			
α	0.93	0.94	0.83			
CR	0.92	0.83	0.85			
AVE	0.71	0.67	0.82			

Extraction method, PCA; Rotation method, Varimax with Kaiser Normalization

Model fit indices: normed χ^2[NC] = 3.44, Goodness of Fit Index = 0.82 < (0.90), adjusted goodness of fit = 0.72 (<0.80), non-normed fit index = 0.94 (≥0.90), root mean square residual = 0.08 (≤0.10), root mean square error of approximation = 0.1 (≤0.10). All t values are significant at $p < 0.05$ level

Loadings of the items on the three factors are in bold

Interviews questions

Q1. *Could you describe your company and your role within the company?*
Q2. *What is the vision and goal of your company from a security viewpoint?*
Q3. *What do you think are the main reasons behind the increased insecurity of supply/distribution chains?*
Q4. *Can you describe the security solutions you have knowledge about?*
Q5. *Have you ever invested in security?*
Q6. *What have been/would be the main reasons for investing/not investing in security?*

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