FACTORS AFFECTING INBOUND LOGISTICS PERFORMANCE IN A MINING COMPANY

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ARTICLE INFO		ABSTRACT
Received:	**16/4/2021**	The study was conducted to identify factors affecting inbound logistics
Revised:	**28/5/2021**	performance in a mining company. The research data was collected from 200 employees in Masan High-Tech Materials – a big mining
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KEYWORDS		analysis (CFA) and structural equation modeling (SEM). The results indicated there were two factors as inbound transportation and
Inbound logistics performance		employee competency that affected inbound logistics performance. In particular, the inbound transportation factor had a strongly impact on
Mining company		inbound logistics performance. Based on these results, some policy
Inbound transportation		recommendations which focused on inbound transportation and
Employee competency		employee competency were proposed for mining companies to improve inbound logistics performance; thereby increasing competitive
SEM		advantage in the market.

The study was conducted to identify factors affecting inbound logistics performance in a mining company. The research data was collected from 200 employees in Masan High-Tech Materials – a big mining company in Thai Nguyen province. The main methods used in this study include exploratory factor analysis (EFA), confirmatory factor analysis (CFA) and structural equation modeling (SEM). The results indicated there were two factors as inbound transportation and employee competency that affected inbound logistics performance. In particular, the inbound transportation factor had a strongly impact on inbound logistics performance. Based on these results, some policy recommendations which focused on inbound transportation and employee competency were proposed for mining companies to improve inbound logistics performance; thereby increasing competitive advantage in the market.

CÁC NHÂN TỐ ẢNH HƯỞNG ĐẾN HIỆU SUẤT LOGISTICS TRONG NƯỚC TẠI MỘT CÔNG TY KHAI THÁC CHẾ BIẾN KHOÁNG SẢN

Nguyễn Thị Bích Hạnh
Khoa Quốc tế - ĐH Thái Nguyên

THÔNG TIN BÀI BÁO		TÓM TẮT
Ngày nhận bài:	**16/4/2021**	Nghiên cứu được thực hiện nhằm mục đích xác định các nhân tố ảnh hưởng đến hiệu suất logistics trong nước của một công ty khai thác
Ngày hoàn thiện:	**28/5/2021**	chế biến khoáng sản. Số liệu được thu thập từ 200 nhân viên trong Công ty Cổ phần Vật liệu Công nghệ cao Masan – một công ty khai
Ngày đăng:	**31/5/2021**	thác chế biến khoáng sản lớn tại tỉnh Thái Nguyên. Các phương pháp phân tích chính được sử dụng là phân tích nhân tố khám phá (EFA),
TỪ KHÓA		phân tích nhân tố khẳng định (CFA) và mô hình cấu trúc tuyến tính (SEM). Kết quả nghiên cứu chỉ ra rằng có 2 yếu tố tác động đến hiệu
Hiệu suất logistics trong nước		suất logistics trong nước là yếu tố vận chuyển trong nước và năng lực của nhân viên. Trong đó, yếu tố vận chuyển trong nước có ảnh hưởng
Công ty khai thác khoáng sản		mạnh mẽ nhất đến hiệu suất của logistics trong nước. Dựa trên kết
Vận chuyển trong nước		quả nghiên cứu, một số khuyến nghị tập trung vào yếu tố vận chuyển trong nước và năng lực của nhân viên được đề xuất nhằm góp phần
Năng lực của nhân viên		giúp các doanh nghiệp khai thác và chế biến khoáng sản cải thiện
Mô hình phương trình cấu trúc		được hiệu suất logistics trong nước, để từ đó nâng cao hiệu quả, lợi thế cạnh tranh trên thị trường.

Nghiên cứu được thực hiện nhằm mục đích xác định các nhân tố ảnh hưởng đến hiệu suất logistics trong nước của một công ty khai thác chế biến khoáng sản. Số liệu được thu thập từ 200 nhân viên trong Công ty Cổ phần Vật liệu Công nghệ cao Masan – một công ty khai thác chế biến khoáng sản lớn tại tỉnh Thái Nguyên. Các phương pháp phân tích chính được sử dụng là phân tích nhân tố khám phá (EFA), phân tích nhân tố khẳng định (CFA) và mô hình cấu trúc tuyến tính (SEM). Kết quả nghiên cứu chỉ ra rằng có 2 yếu tố tác động đến hiệu suất logistics trong nước là yếu tố vận chuyển trong nước và năng lực của nhân viên. Trong đó, yếu tố vận chuyển trong nước có ảnh hưởng mạnh mẽ nhất đến hiệu suất của logistics trong nước. Dựa trên kết quả nghiên cứu, một số khuyến nghị tập trung vào yếu tố vận chuyển trong nước và năng lực của nhân viên được đề xuất nhằm góp phần giúp các doanh nghiệp khai thác và chế biến khoáng sản cải thiện được hiệu suất logistics trong nước, để từ đó nâng cao hiệu quả, lợi thế cạnh tranh trên thị trường.

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1. Introduction

With today's globalized and unpredictable business conditions, market rivalry has become more severe and competitive. Many businesses have concentrated on logistics to make their business operations more reliable and cost-effective in order to thrive and succeed in such circumstances. According to [1], businesses must pay attention to their inbound logistics in order to achieve logistics efficiency.

Inbound logistics, as defined by [2], is the process of delivering materials or finished inventory from a supplier to a purchasing organization. It improves business productivity by facilitating the transportation of materials, spare parts, and finished goods needed for day-to-day operations. A successful inbound logistics program can lead to higher-quality goods, lower costs, and increased sales. It would also increase customer loyalty while lowering total overhead and reducing squandered materials. As a result, evaluating inbound logistics performance is crucial when attempting to enhance logistics and boost company's competitive advantages.

Logistics researchers [3], [4] have viewed inbound logistics performance in a great number of ways. As organizations have different conflicting goals, defining and measuring inbound logistics performance can be difficult for researchers. Thus, the definition of the inbound logistics performance is 'ultimately up to the evaluator' [5]. Inbound logistics performance is defined by [6] – [8] as effectiveness and efficiency in performing inbound logistics activities.

Logistics is also important in Vietnam's competitive mining market. The relevance of logistics functions is becoming increasingly apparent to mining companies. They are looking for the most cost-effective way to transport their large quantities of products while also improving their logistical solutions. Despite the importance of the mining industry, few studies on logistics in the mining sector have been conducted in Vietnam. Inbound logistics, in particular, received little attention because the logistics costs of mining industry are considered negligible. On the other hand, although inbound logistics performance assessment and its implementation are critical components for businesses, it is surprising to note that the inbound logistics performance rarely captured in studies of Vietnamese researchers. They appear to more concerned with supply chain and logistics in general. As a consequence, there is a knowledge gap that needs to be addressed. Therefore, in order to fill this research gap, this study aims to identify critical factors that affect inbound logistics performance in a mining company by focusing on Masan High-Tech Materials Company. In addition, this study also proposes some solutions for managerial implication to improve inbound logistics performance.

In the section that follows, the detailed methods of the study will be described. Following this, the results will be discussed. Finally, the study's conclusions and discussion will be presented.

2. Research methodology

2.1. Conceptual framework

From the framework shown in the Figure 1, the study underlined the existence of four factors that determines inbound logistics performance including inbound transportation, information technology, government policies and employee competency. The study also determined three measurements including cost saving, delivery time and safety to assess inbound logistics performance.

2.2. Hypotheses

Factors affecting inbound logistics performance have been highlighted in academic and practical fields abroad. Green et al. [9] found that the inbound transportation is a critical activity in the inbound logistics process. It provides a buyer with both location and time utilities, as well as contributing to inbound logistics performance in terms of cost, speed, and consistency. The entire system would not be able to operate at its maximum capacity without the efficient

movement of products and materials from suppliers and vendors. Other studies reported that information technology could improve inbound logistical efficiency, effectiveness, flexibility, cost, and service quality [10] – [12]. Liu et al. [13] examined the information technology capability and found positive effects on inbound logistics performance. Havenga [14] pointed out that the degree and pace at which governments liberalize the logistics including adequate infrastructure investments, determines the performance of the logistics trade cycle. Daw et al. [15] discussed that government laws and policies are one of the most important factors affecting inbound logistics performance of a firm. Hamza [16] discovered that worker's proficiency was the main factor affecting inbound logistics excellence in an organization.

Following the literature, this study chooses to establish the four hypotheses as follows:

H1: Inbound transportation impacts significantly on inbound logistics performance.

H2: Information technology impacts significantly on inbound logistics performance.

H3: Government policies impact significantly on inbound logistics performance.

H4: Employee competency impacts significantly on inbound logistics performance.
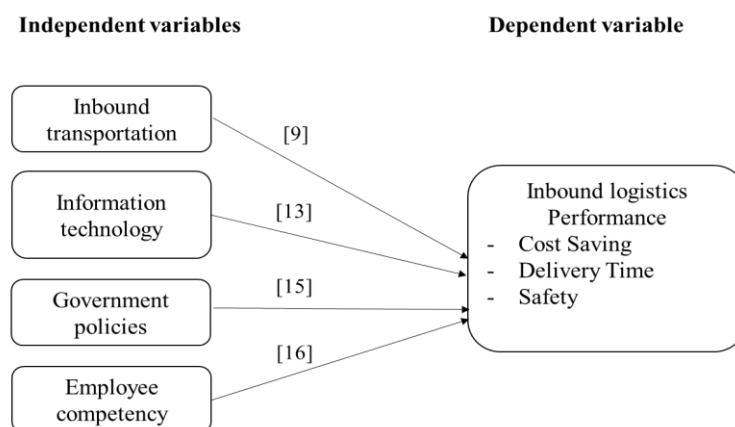
Figure 1. *Conceptual framework*

Source: Data analysis compiled by the researcher

2.3. Research method

A questionnaire survey was administered to collect the primary data. The questionnaires were sent to employees of the Masan High Tech Materials, a big mining company in Thai Nguyen province. According to Solvi's Formula, the researcher decided to collect 200 respondents of the company. To be more specific, the sample included 86 employees from supply chain department, 52 employees of maintenance department and 62 employees from processing department, which are the most involved in inbound logistics of the company. The question set includes 2 parts. Part I is profile of respondents on gender, age and working years. Part II is the answer about factors impacting on inbound logistics performance of Masan High Tech Materials. Moreover, the secondary data were gathered from journals and articles, which were utilized to present the evidence and to substantiate the arguments and other published sources to establish the theoretical framework. Five-point Likert-type scale was used. Respondents were asked to rate their level of agreement with each item, where 1 represented "Strongly Disagree" and 5 represented "Strongly Agree".

For a start, the demographic data were analyzed for respondent profiles by Statistical Package for Social Sciences (SPSS) software, which helps to explain and describe the characteristics of the sample that is being studied and to compare with the sampling frame and check the representativeness of the sample. Then, the study used Exploratory Factor Analysis (EFA) whose main purpose is to discover the factor structure of the measurement for the variables and to

examine its reliability. After that, structural equation modelling (SEM) was used to analyze the relationships between latent variables. SEM is known as a confirmatory method of validating the measurement model of latent constructs through Confirmatory factor analysis (CFA). CFA assists in evaluating the unidimensionality and validity of the constructs.

3. Results and discussion

3.1. Demographic characteristics

According to a detailed analysis of the demographic characteristics, 49.5% of respondents were female, while 50.5% of respondents were male. 35% of sampled employees were less than 25 years old, 34.5% of respondents were between 26 to 40 years old, and 30% of respondents were above 40 years. The majority of respondents (45%) had worked in their firm for less than 2 years, 35% of respondents had worked in the company between 3 to 5 years and 20% of respondents had worked more than 5 years.

3.2. Reliability and validity

Firstly, 200 respondents were selected for exploratory factor analysis. Principle axis factoring with Promax rotation is the most commonly used in factor analysis. Items with factor loadings of less than 0.5, a minimum threshold value recommended, or items that do not load any factor or load on multiple factors are eliminated.

Table 1. *Analyses of latent variables reliability and validity*

Latent variables	Items	Factors loading	P-value of Bartlett's Test	Cronbach's alpha
Inbound transportation	IB1	0.729	0.000	0.863
	IB2	0.950		
	IB3	0.758		
	IB4	0.668		
Information technology	IT1	0.842	0.000	0.931
	IT2	0.855		
	IT3	0.859		
	IT4	0.885		
	IT5	0.341		
Government policies	GP1	0.905	0.000	0.840
	GP2	0.885		
	GP3	0.881		
	GP4	0.867		
	GP5	0.830		
Employee competency	EC1	0.938	0.000	0.931
	EC2	0.924		
	EC3	0.851		
Inbound logistics performance	CS	0.677-0.836	0.000	0.818
	DT	0.805-0.869		
	ST	0.736-0.845		
Model fit indices	**CMIN/df = 2.245, GFI = 0.819, CFI = 0.901, RMSEA = 0.079**			

Data analysis showed that Kaiser-Meyer-Olkin (KMO) values of the constructs were higher than 0.6 and the small values of the significance level was less than 0.05. This means that independent variables were appropriate for factor analysis [17]. Factor analysis of four independent variables including inbound transportation, information technology, government policies and employee competency explained 74.170% of variance. Factor analysis for three

items of inbound logistics performance explained 63.124% of variance. All Cronbach's alpha values were above 0.80, exhibiting acceptable reliability [18].

Then, the construct validity was evaluated. The results showed that all standardized factor loadings for corresponding latent variables were above 0.60. In addition, to assess the overall model goodness of fit, the four most popular indices including Chi-square, goodness-of-fit index (GFI), comparative fit index (CFI), and root mean square error of approximation (RMSEA) were used. According to [17], the Chi-square (CMIN/df) value which is equal to or smaller than 3 is good fit and smaller than 5 is acceptable fit. Many researchers interpret GFI in the 0.80 to 0.89 range as representing reasonable fit; scores of 0.90 or higher are considered evidence of good fit [19], [20]. The CFI should be greater than 0.9 to indicate a satisfactory model fit, with value close to 1 suggesting a very good fit [21]. Browne and Cudeck [22] suggest that a value of RMSEA below 0.05 indicated close fit and that values up to 0.08 are reasonable. As shown in Table 1, goodness-of-fit indices were all well within suggested limits. In conclusion, all of the reliability and validity of scales were verified.

3.3. Structural equation model (SEM) and hypotheses testing

Then, the model in Figure 1 was tested using SEM. The model fit indices were shown in Figure 2 as follows: CMIN/df = 2.501, GFI = 0.819, CFI = 0.901, RMSEA = 0.077. Therefore, the model was well-fitted. The results indicated that the effect of inbound transportation on cost saving was found to be significant (β=0.034, p-value<0.05). The effect of employee competency on cost saving was also computed to be significant (β=0.028, p-value<0.05). However, the impact of information technology and government policies on cost saving were not statistically significant as the p-values were greater than 0.05. The findings revealed that inbound transportation significantly impacted delivery time (β=0.431, p-value<0.05). In addition, the effect of employee competency on delivery time was also significant (β=0.355, p-value<0.05). However, the influence of information technology and government policies on delivery time was not significant. The results showed that inbound transportation (β=0.426, p-value<0.05) and employee competency (β=0.310, p-value<0.05) significantly affected safety, whereas the effects of information technology and government policies on safety were not statistically significant.
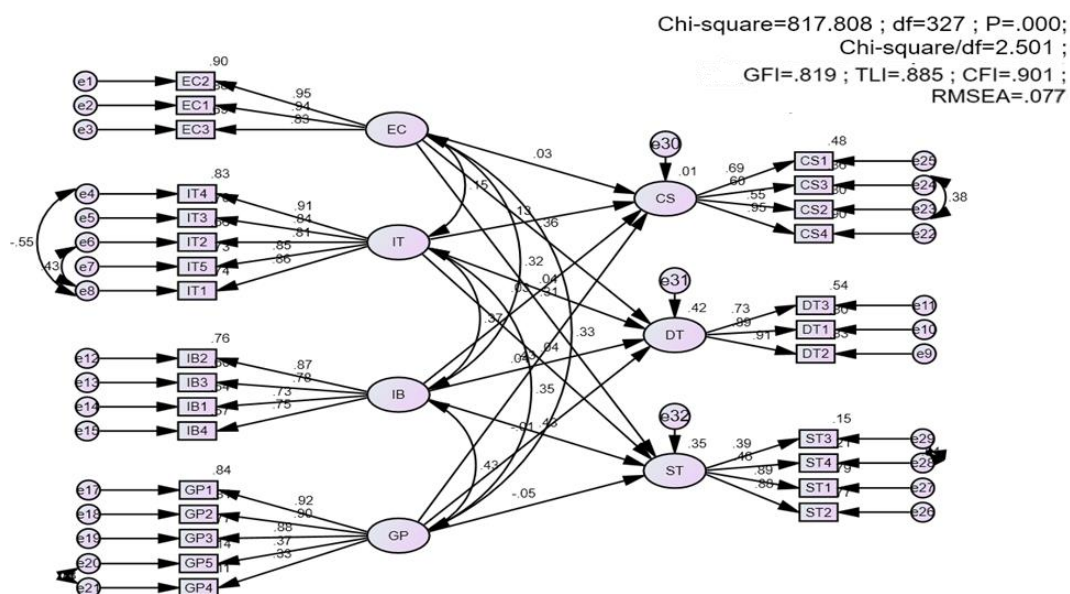

Figure 2. *SEM results*

Figure 2 presents the Structural equation model (SEM) results of this study. SEM is used to determine whether the exogenous (independent) variables are causally related to the endogenous (dependent) variables [23]. The SEM findings showed that inbound transportation (IB) and employee competency (EC) had impacts on three items of dependent variables including cost saving (CS), delivery time (DT) and safety (ST). The two remaining factors: information technology (IT) and government policies (GP) had no effects on components of inbound logistics performance.

Hypotheses testing results were shown in Table 2. The results depicted that inbound transportation and employee competency had impacts on inbound logistics performance, which provided support for H1 and H4. These results were concordant with the findings of [9] and [16]. In particular, the inbound transportation was the highest contributing predictor to explain inbound logistics performance. However, information technology and government policies were not statistically significant. Therefore, H2 and H3 were rejected, which were not consistent with the findings of [13] and [15].

Table 2. *Hypotheses testing results*

Hypotheses	Coefficients	p-value	Results
H1	0.303	0.000	Supported
H2	0.011	0.871	Rejected
H3	0.045	0.577	Rejected
H4	0.298	0.000	Supported

4. Conclusion and recommendation

4.1. Conclusion

This study was carried out to identify factors affecting inbound logistics performance in mining companies by focusing on Masan High-Tech Materials (MHT) as a case study. The survey resulted from 200 employees who directly related to the company's inbound logistics activities and given their opinions about the inbound logistics performance of MHT.

The study revealed that inbound transportation had a significant impact on inbound logistics performance. It was also the most influential factor on the performance of inbound logistics. This result is understandable as inbound transportation have a big influence on the company's cost. Inbound transportation costs are generally very high for mining companies that need to transfer a wide variety of goods, as end users expect their goods to arrive quickly. As a result, successful inbound transportation control and management will contribute to improved inbound logistics performance, increasing a company's productivity and overall profitability. Inbound logistics performance was another factor that affects employee competency. From the findings, sufficient skills, training and the level of education of logistics employees had significant effects on inbound logistics performance in the company. The study established that employee competency helped in applying learned educational skills in inbound logistics activities. It is crucial in deciding the job/role/tasks that a given staff is capable of performing, as well as making work simpler in terms of understanding what needs to be accomplished in a given area of activity. The two remaining factors are information technology and government policies had no impact on inbound logistics performance. This conclusion may contrast with results from previous findings in different countries and on different sectors of industry.

This study has certain limitations. Firstly, the study just focused on inbound logistics and not covered the entire process. Analysis of factors related to outbound logistics and other logistics activities could be exercised as future studies. Secondly, the findings of this study were concerned with mining sector. Future researches about other outstanding industries of Vietnam such as garment and agriculture might be investigated. In addition, as inbound logistics systems

are characterized by many stakeholders, a larger and more diverse population of stakeholders should be considered for future studies.

4.2. Recommendation

Based on the study findings, the researcher recommends several suggestions for mining companies to enhance their inbound logistics performance.

Firstly, the company should increase full truckload consolidation of inbound shipments wherever possible to minimize freight and unloading costs. In addition, many vendors provide freight allowances for buying orders. When handling a large number of vendor shipments, however, it can be difficult to decide which alternative is the most cost-effective. To keep things real, the organization can compare allowances to real-time market costs using a transportation management system (TMS). Making decisions in the now is rather than examining historical data with multiple interpretations.

Secondly, in terms of employee competency, the company should hire agents to supervise inbound logistics employees who receive on-the-job training in order to develop their skills and expertise to enhance efficiency of inbound logistics performance. The employees need to be trained on aspects of inbound logistics performance on a regular basis. This could happen during induction and through short courses, workshops, and seminars offered by organizations for employees in order to fully understand and promote the concept of inbound logistics performance.

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