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A structure equation modeling of logistics capability on firm performance of autopart manufacturing industry in Thailand

Phat Pisitkasem

Department of Cooperatives, Faculty of Economics, Kasetsart University, Bangkok 10900, Thailand

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Abstract

The objectives of this research were to investigates the effects of innovation capability, flexible capability, service capability on logistics performance and marketing performance. In addition, this study examined whether logistics performance affects marketing performance. Also, the effects of logistics performance and marketing performance on financial performance were tested. The studied samples in this research consisted of 430 autopart manufacturers in Thailand. The study was conducted through questionnaires, and data were analyzed by using descriptive and inferential statistics in terms of percentages, means, standard deviations, and hypothesis tests with confirmatory Factor Analysis (CFA). Responses from 430 questionnaires showed that most manufacturers were Thai nationality with registered capital of less than 50 million baht, the average number of employees was 178.74, and average business age was 28.14. Most respondents were male with bachelor degree, average 37.12 years old, and in the position of assistant managers with an average 18.34 years of experience. All hypotheses were tested. The results showed that innovation capability, flexible capability, and service capability positively affect logistics performance and marketing performance at the significant level of .01. Logistics performance positively affects marketing performance at the significant level of .01. Logistics performance and marketing performance positively affect financial performance at the significant level of .01.

Introduction

Nowadays, logistics development is a main strategy. In the Thailand 20-year Strategic Plan and Reforms (2017–2036), one of the main goals is logistics and supply-chain development in the industrial sector to be best prepared for the year of 2036 (Office of The National Economic and Social Development Board, 2018). This research study covered various logistic capabilities. Interestingly, three capabilities as variables in this study are widely used in many international research papers.

This research study focused on Thai autopart manufacturing industry in various aspects of logistics areas. Many problems in this industry need to be defined, such as problems about high logistics costs compared with international standards, problems about infrastructure

E-mail address: phat.p@ku.th.

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(roads), problems about logistics activities (forecasting), and problems of IT for logistics (resource planning). Apparently, small and medium businesses cannot invest in the production of electric vehicles. Because of all of these concerns, carmakers and autopart manufacturers need to operate with higher performance.

Companies in the Thai autopart industry need to find ways and be ready for near-future competition. Also, the autopart manufacturers have been pressured by car assembly plants to cut costs of autoparts year by year. In the academic area, few research papers in Thailand mention about the solutions for these problems. Therefore, it is worth for the researcher to study this area. The topic of this study is "A structure equation modeling of logistics capability on firm performance of autopart manufacturing industry in Thailand." Also, logistics concepts and practices fit the current competitive situation in the autopart manufacturing industry. The researcher aims to use the study results in the academic area.

Research objectives to investigating effects among variables:

1. The effects of innovative capability on logistics performance and marketing performance in the autopart manufacturing industry.
2. The effects of flexibility capability on logistics performance and marketing performance in the autopart manufacturing industry.
3. The effects of service capability on logistics performance and marketing performance in the autopart manufacturing industry.
4. The effects of logistics performance on marketing performance in the autopart manufacturing industry.
5. The effects of logistics performance and marketing performance on financial performance in the autopart manufacturing industry.

Literature Review

The researcher created the conceptual framework from the literature review by using the concept of logistics performance, the concept of organizational performance, and background of the autopart manufacturing industry. These concepts and knowledge are presented as the following.

Innovative capability (INN) is modern techniques, system, technologies, and concepts relating to logistics management. An organization can operate more effectively, such as in production, distribution, checking, and information sharing (Yang, Marlow, & Lu, 2009). Flexibility capability (FLE) is the ability to adapt to an unexpected situation in activities, such as distribution, space utilization, ordering process, and delivery. The organization can operate more effectively and serve customers' needs (Jacob & Chase, 2008). Service capability (SER) is the ability to serve customers' needs at a high service level. The organization can operate smoothly, such as with on-time delivery, right quantity, high quality, fleet management, after-sales service (Lu & Yang, 2008). Logistics performance (LOG) comprises storage costs, warehousing costs, delivery costs, product costs, error costs, perfect order fulfilment, on-time delivery, inventory turn (Lu &Yang, 2008; Pisitkasem, 2013). Marketing performance (MAR) is having good relationship with customers, searching for new customers, and searching for new customers with support from business partners (Yang et al., 2009). Financial performance (FIN) is having high financial performances (sales revenues, profits, return on assets, and return on investment in the current year, higher than those of the previous year) (Jeffer, Muhanna, & Nault, 2008; Lu & Yang, 2008).

The relationships among variables in the framework of this study are presented in other research papers as follows. Kafetzopoulos and Psomas (2015) argued that innovation capability had a relationship with logistics performance. Aziz, Razak, Hussin, Yaacob, and Merican (2017) argued that logistics flexibility capability had a relationship with logistics performance. Ho and Chang (2015) noted that value-added service capability caused the improvement of Logistics services performance. Schramm-Klein and Morschett (2003) noted that logistics performance affected marketing performance. Toyli, Häkkinen, Ojala, and Naula (2008) found that logistics performance had a relationship with financial performance. Yu, Ramanathan, and Nath (2016) revealed that marketing performance had a relationship with financial performance and their mediator was operation capability.

In the conceptual framework, Innovation Capability (INN) has measurement scales: INN1 modern logistical technologies, INN2 tracking systems for distribution, INN3 modern warehousing data collection and INN4 modern innovation for purchasing. Flexibility Capability (FLE) has measurement scales: FLE1 flexible in distribution process, FLE2 flexible in logistics activities, FLE3 flexible in space usage and FLE4 flexible to changes in order. Service Capability (SER) has measurement scales: SER1 on-time delivery, SER2 good vehicle selection, SER3 no product loss during delivery and SER4 very low return rate. Logistics performances (LOG) has measurement scales: LOG1 decreased storage costs, LOG2 decreased warehousing costs and LOG3 decreased transportation costs. Marketing performances

(MAR) has measurement scales: MAR1 building customer relationship, MAR2 Customer satisfaction and MAR3 customer retention. Financial performances (FIN) has measurement scales: FIN1 increased profits, FIN2 increased return on assets and FIN3 increased sales revenues.

The hypotheses in this research (Figure 1) were as follows.

H1: Innovative capability positively affects logistics performance.

H2: Innovative capability positively affects marketing performance.

H3: Flexibility capability positively affects logistics performance.

H4: Flexibility capability positively affects marketing performance.

H5: Service capability positively affects logistics performance.

H6: Service capability positively affects marketing performance.

H7: Logistics performance positively affects marketing performance.

H8: Logistics performance positively affects financial performance.

H9: Marketing performance positively affects financial performance.

Methodology

This study used empirical quantitative research by questionnaire for collecting data.

Population and Samples

The population of this study was autopart manufacturing industry in Thailand listed in the book of "Thai Automotive Industry Directory". The total was 1,964 companies.

In this study, the number of samples was 20 times of observed variables (Hair, Black, Babin & Anderson, 2010). The conceptual framework comprised 21 variables. Therefore, the sample size was at least 420 (the calculation is 21×20 = 420). Simple random sampling was effective for this study. After the data collecting process, the number of completed filled questionnaires was 430, and all data from them could be used in the data analysis process.

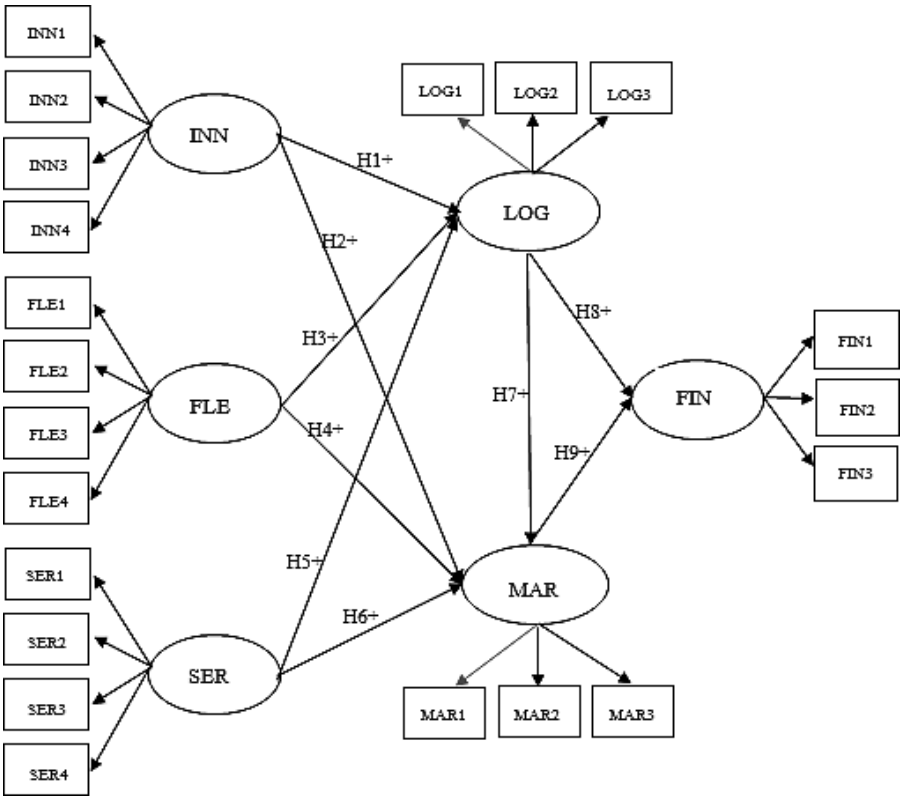

Figure 1 Conceptual Framework of logistics capabilities affecting organizational performances in autopart manufacturing industry in Thailand

Research Instrument

The research instrument for collecting data was a questionnaire comprising 7sections. The first section was about innovation capability (4 questions). The second section was about flexibility capability (4 questions). The third section was about service capability (4 questions). The fourth section was about logistics performances (3 questions). The fifth section was about marketing performances (3 questions). The sixth section was financial performances (3 questions). In the first to sixth sections, interval scales were used. Rating scales in these sections eased respondents to answer the questions. The questions in the one to six sections were developed from literature review in this research. The seventh section was about respondents (5 questions) and their organizations (5 questions). Nominal and ordinal scales were used in this section.

Instrument Validity and Reliability

Content validity iwas examined by Item-Objective Congruence Index (IOC). Three experts in the autopart manufacturing industry evaluated the questionnaire. The IOC score should be a least 0.5. For the questionnaire in this study, all questions could be used.

Reliability was checked by Cronbach's Alpha Coefficient. Data from 30 samples were used in this process. The result was that all variables' coefficient values were higher than 0.7 (Hair et al., 2010; Nunnally, 1978). Also, the Item-Total Correlation values of all questions were higher than 0.3 (Field, 2005). Therefore, all variables in the framework were reliable, as presented in Table 1.

Confirmatory Factor Analysis (CFA) was used in this study. Hair et al. (2010) noted that Standardized Factor Loading is acceptable when factor loading is at least 0.5, Average Variance Extracted (AVE) is at least 0.5, and Construct Reliability (CR) is at least 0.7 (Hair et al., 2010). The results of reliability test and CFA are also demonstrated in Table 1.

With the discriminant validity test, the maximum value of correlation coefficient plus standard error (upper-bound) was less than 1 so measurement scales of different variables in the framework were discreate (Anderson, 1987).

Data Analysis

Descriptive statistics in this study were frequency, percentage, mean, and standard deviation. These results help to analyze details about organization and respondents.

For hypothesis testing the researchers examined the initial agreement for the analysis of multivariate statistics for the analysis of structural equation model (SEM), including; (1) normality (2) distribution homogeneity (Homoscedasticity) and (3) the linear relationship between the parent and the dependent variable (Linearity). All variable data were in accordance with all 3 preliminary agreements.

Results

Data of Organizations and Respondents

The number of completed filled questionnaires was 430. Data of organizations are presented as the following. First, the average number of employees of these companies was 178. Second, the average company age was 28.14 years. Third, 58.37 percent of companies had registered capital of less than 50 million baht, and 30.46 percent of them had registered capital of 50–200 million baht. Fourth, 61.63 percent of companies were Thai nationality, and 30.00 percent of them were Japanese nationality. Data of respondents are also presented as the following. First, the average age of the respondents was 37.12 years. Second, the respondents' average year of experience in industrial sectors was 18.34 years. Third, 48.85 percent of respondents were assistant managers. Fourth, 66.97 percent of respondents were male, and 33.03 percent of them were female. Fifth, 54.65 percent of respondents had earned Bachelor's degree, and 35.17 percent of them had earned Master's degree.

Table 1 Results of reliability test and CFA

Variables	Alpha	AVE or ρ_v	CR or ρ_c
Innovative capability	0.886	0.617	0.912
Flexibility capability	0.899	0.608	0.927
Service capability	0.883	0.702	0.904
Logistics performance	0.891	0.856	0.947
Marketing performance	0.894	0.814	0.933
Financial performance	0.907	0.791	0.912

Data of Organizations' Capabilities and Performances

Innovative capability in organizations is presented in average scores (the full score of 5) as the following: INN3 having modern data collecting and sharing system of warehousing management (4.01), INN2 using checking and tracking systems for distributing new products, such as GPS tracking, electronic seals (e-seal) (3.96), INN4 using modern innovation for purchasing raw materials (3.91) and INN1 using modern technologies for logistics technologies all the time, such as RFID (Radio Frequency Identification) (3.87). All of these items as observed variables scored at the high level.

Flexibility capability in organizations is presented in average scores as the following: FLE1 being flexible in distribution process in every situation (4.11), FLE3 being flexible to be able to full space usage, such as storage areas, truck load (4.08), FLE2 being flexible in logistics activities to serve customers' needs (4.02), and FLE4 being able to change order items before suppliers deliver them (3.98). All of these items as observed variables are scored at the high level.

Service capability in organizations is presented in average scores as the following: SER1 on-time delivery with consistency (4.08), SER3 no product loss during delivery (4.04), SER2 good vehicle type selection for each order (3.87), and SER4 very low return rate from customers (3.73). All of these items as observed variables scored at the high level.

Logistics performances of organizations are presented in average scores as the following: LOG3 decreased transportation costs compared with the previous year (3.96), LOG2 decreased warehousing costs compared with the previous year (3.88), and LOG1 decreased storage costs compared with the previous year (3.84). All of these items as observed variables scored at the high level.

Marketing performances of organizations are presented in average scores as the following: MAR1 building relationship with current customers (inquiry responses) (4.01). MAR2 Customer satisfaction (3.96), and MAR3 customer retention (3.94). All of these items as observed variables scored at the high level.

Financial performances of organizations are presented in average scores as the following: FIN1 increased profits compared with the average result of the last three years (3.98), FIN3 increased sales revenues compared with the average result of the last three years (3.91), and FIN2 increased return on assets compared with the average result of the last three years (3.84). All of these items as observed variables scored at the high level.

Hypothesis Tests of Structural Equation Model

The data analysis revealed the model fit index as the following: chi-square (χ^2) = 200.728, degree of freedom (df) = 198, p-value = .442 (higher than .05), relative chi-square (χ^2/df) = 1.013 (less than 2), GFI = 0.973 (higher than 0.9), AGFI = 0.961 (higher than 0.9), and RMSEA = 0.003 (less than 0.05) (Hair et al., 2010).

The structural equation model (SEM) is presented in Figure 2. Direct effect, indirect effect, and total effect are shown in Table 2.

H1 is accepted. Innovative capability positively affects logistics performance at the significance level of .01 and the regression weight is 0.117.

H2 is accepted. Innovative capability positively affects marketing performance at the significance level of .01 and the regression weight is 0.194.

H3 is accepted. Flexibility capability positively affects logistics performance at the significance level of .01 and the regression weight is 0.642.

H4 is accepted. Flexibility capability positively affects marketing performance at the significance level of .01 and the regression weight is 0.531.

H5 is accepted. Service capability positively affects logistics performance at the significance level of .01 and the regression weight is 0.174.

H6 is accepted. Service capability positively affects marketing performance at the significance level of .01 and the regression weight is 0.209.

H7 is accepted. Logistics performance positively affects marketing performance at the significance level of .01 and the regression weight is 0.487.

H8 is accepted. Logistics performance positively affects financial performance at the significance level of .01 and the regression weight is 0.742.

H9 is accepted. Marketing performance positively affects financial performance at the significance level of .01 and the regression weight is 0.433.

Discussion

Innovative capability positively affects logistics performance. This result can be supported by the research papers of Kafetzopoulos and Psomas (2015) and Vecchi and Brennan (2009). They noted that innovative capability including modern technologies had a strong impact on efficiency and cost reduction of the organization. The change in innovation, adoption, and technologies enhanced its operational performance and competitiveness.

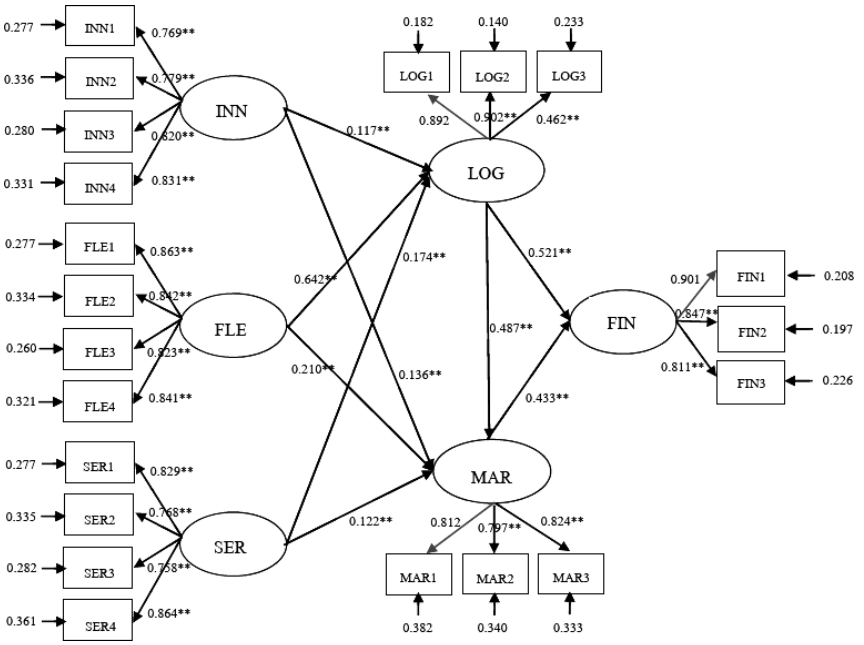

Figure 2 Structural equation model of logistics capabilities affecting organizational performances in autopart manufacturing industry in Thailand

Table 2 Direct effect, indirect effect, and total effect

Endogenous Variables	LOG			MAR			FIN		
Exogenous Variables	DE	IE	TE	DE	IE	TE	DE	IE	TE
INN	0.117**	-	0.117**	0.136**	0.058**	0.194**	-	0.145**	0.145**
FLE	0.642**	-	0.642**	0.210**	0.321**	0.531**	-	0.567**	0.567**
SER	0.174**	-	0.174**	0.122**	0.087**	0.209**	-	0.189**	0.189**
LOG	-	-	-	0.487**	-	0.487**	0.521**	0.221**	0.742**
MAR	-	-	-	-	-	-	0.433**	-	0.433**
Observed Variables	INN1	INN2	INN3	FLE1	FLE2	FLE3	SER1	SER2	SER3
Validity	0.592	0.611	0.674	0.701	0.765	0.722	0.687	0.714	0.723
Observed Variables	LOG1	LOG2	LOG3	MAR1	MAR2	MAR3	FIN1	FIN2	FIN3
Validity	0.604	0.701	0.599	0.732	0.789	0.801	0.813	0.821	0.786
Latent Variables		LOG			MAR			FIN	
R^2		0.778			0.742			0.829	

Note: χ^2 = 200.728, df = 198, χ^2/df = 1.013, *p*-value = .442, GFI = 0.973, AGFI = 0.961, RMSEA = 0.003.

Innovative capability positively affects marketing performance. Other papers also revealed the same result. Brem, Maier, and, Wimschneider (2016) and Lambert, Stock, and Ellram (1988) noted that electronic data interchange (EDI) between supply-chain partners and point-of-sale with barcode system helped improve customer satisfaction and relationship.

Flexibility capability positively affects logistics performance. This finding is demonstrated in other papers as well. Han, Wang, and Naim (2017) and Jacob and Chase (2008) noted that having flexibility and technologies in management, production volumes, and product models improved operational performances.

Flexibility capability positively affects marketing performance. Research papers in this area also confirmed the same result. Jin, Vonderembse, Ragu-Nathan, and Smith (2014) and Suharitdamrong (2008) noted that an organization using flexibility approach could improve its operational performances.

Service capability positively affects logistics performance. This result is supported by the research papers by Pisitkasem (2013) and Sachdev and Merz (2010). They mentioned that before and after sales services, information sharing was needed among business partners and logistics services.

Service capability positively affects marketing performance. This result is supported by the research papers of Daugherty, Chen and Bruce (2011) and Suthiwartnarueput, Bhamornsathit, and Duangphastra (2004). They mentioned that customer services started before customers arrived and needed to be planned further.

Logistics performance positively affects marketing performance. This finding is demonstrated in other papers as well. Yildiz (2016) and Liu, Grant, McKinnon, and Feng (2010) mentioned that logistics operation became a competitive dimension to reduce costs and increased the service level.

Logistics performance positively affects financial performance. Research papers in this area also confirmed the same result. Lu and Yang (2008) and Jeffer et al. (2008) mentioned that asset management assessment for logistics activities used asset utilization, such as equipment, machines, cash for operation.

Marketing performance positively affects financial performance. This finding is demonstrated in other papers as well. Lu and Yang (2008) and Kim (2006) noted that capability to serve customers' needs affected the company's profit. Marketing staff had to identify a market target to understand decision making and life styles. The company could cut costs and generate profits when the flow of raw-materials and products was smooth.

Conclusion and Recommendation

1. The organization in the autopart industry can have good logistics performances when reducing costs of products, processes, storage, warehousing, and delivery. Also, it needs to increase on-time delivery, fill rate, innovation, and flexibility.

With innovative capability, the organization should use new technologies. For instance, it should have the system to collect and share data for modern warehouse management, and the purchasing system to connect with its business partners. Apparently, it can control costs, avoid mistakes, and increase efficiencies of logistics processes. With flexibility capability, the organization should have flexibility in its operation. For instance, it should change steps of distribution, control space utilization, and change logistics plans. These can help the organization to reduce holding costs, warehousing costs, and transportation costs. With service capability, the organization should deliver products perfectly. As a result, delivery costs are low. The delivery department can select truck size for each order. It can deliver with full-truck loads and low percentage of product damages. The level of product return becomes lower.

2. The organization in the autopart industry can increase marketing performance if the relationship with current customers is maintained. The customers are satisfied with its products and services. The good reputation of the organization is a key of searching for new customers. Current customers or partners are another way for getting contact with new customers. As a result, the organization can generate higher revenues. Therefore, focusing on increasing innovation, flexibility, and service capabilities is crucial.

With innovative capability, the organization should always use new logistics technologies. For instance, it can use RFID to check and track products during the distribution process. Also, GPS tracking or electronic seals can help satisfy the customers' needs. With flexibility capability, the organization can operate with flexibility. Its design team can introduce various product features to serve customers' needs. This process needs to be quick to increase customer satisfaction. With service capability, the organization should completely fulfill the order to make customers feel satisfied with the service. Also, the delivery staff needs to keep a low rate of losses or zero product damage during delivery. In a case that the customers receive poor products or packaging, they may decide to return such.

3. Having high financial performances (sales revenues, profits, return on assets, and return on investment in the current year higher than those of the previous year), the organization in the autopart industry needs to give priority on logistics and marketing performances.

With logistics performances, the organization needs to have a process to effectively control and reduce holding costs, warehousing costs, and transportation costs. For instance, the organization should use logistics technologies. Also, it should collaboratively work with business partners, and avoid unpredictable cases to be able to control costs. This means that the organization can use effectively resources. As a result, it can cut costs and increase profits. With marketing performances, the organization should strengthen the relationship with customers, and maintain a high service level. As a result, these customers keep buying the organization's products and services.

4. In academic areas, the training program need to focus on topics of innovation, flexibility and service that can improve logistics, marketing and financial performance. The people working in various industries can adapt these topics in their companies in order to cut costs and enhance customer loyalty. These people will realize the importance of the modern technologies for daily operation.

Related research studies can be recommended for other researchers as the following:

1. The research study can focus on other capabilities beyond the areas of innovation, flexibility, and service. The researcher can get wider research results.

2. The research study can use factors from this study with other industries. They can compare the results and then come up with new concepts.

Conflict of Interest

There is no conflict of interest.

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