The Mediating Impact of *Halal* Logistics on Supply Chain Resilience: An Agency Perspective

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ABSTRACT

This study examines the impact of *Halal* logistics on supply chain resilience. The study is underpinned by the agency theory. *Halal* logistics was studied as an Agent of governance and control in the multiple principal-agent model that exists in a typical supply chain. A field survey has been conducted and the research population is the Malaysian pharmaceutical industry. 10 organizations were surveyed. The survey instrument is a structured self-administered questionnaire. The responses were quantified using fuzzy analytical hierarchy process approach. A fuzzy logic method was used to measure the resilience of each organization. Pearson's correlation and multiple regression analysis were then carried out on SPSS to test the research hypothesis. The results have found that *Halal* logistics which acts as a governing mechanism for regulation and control in the supply chain, mediates the relationship between each of capabilities and vulnerabilities (predictors) and supply chain resilience (outcome).

Keywords: Supply Chain Management, Resilience, *Halal*, Agency Theory, Principal, Agent
JEL Classifications: D2, L2, M1

1. INTRODUCTION

In the manufacturing industry, building a resilient supply chain is an ongoing activity that requires process improvements, management, assurance and control within and across organizations. The increase in complexity of global supply chains has exposed the limitations of control oversights, non-alignment and asymmetry of procurement strategies within supplier relationships.

Agency theory explains the relationship between principals (delegating authority) and agents (contractor) in business. It is concerned with resolving problems in this principal-agent relationships. These problems arise due to conflict of interest or different attitudes towards risk between the principal and the agents. Because of different risk tolerances, the principal and agent may each be inclined to take different actions. This relationship is very important when considering how to structure a supply chain when it is perceived as a collaboration of institutions.

From the perspective of Agency theory, the supply chain consists of multiple principal-agent relationships whose goal is centered at delivering value at the interfacing of their activities at the supply chain nodes. So when an already established regulatory assurance mechanism is embedded into supply chain events, the arrangements devised to monitor these multiple principal-agent relationships are themselves agents in these relationships. This paper examines the mediating impact of *Halal* logistics and assurance control as regulatory agents on supply chain resilience.

Supply chain risks associated with any industry is unique and different between industries due to their distinct operating environment and conditions. However, the risk inherent in a particular industry is similar for organizations that are in the same industry and category (Tang, 2006). Due to conflicts of goals and interests between the principal and the agent in the supply chain relationships, it is therefore expedient to research on what is needed to manage a particular supply chain structure.

The management of supply chain in the pharmaceutical industry is critical and complex. This is due to the large cost of error and reactiveness (Eyinda, 2009; Mustaffa and Potter, 2009; Turhan and Vayvay, 2009). The pharmaceutical industry is chosen for this research.

Previous research on supply chain resilience have concentrated efforts on qualitative assessments and explorative deductions. This has been a major hindrance in drawing statistical inference about causalities. Of note however, recent studies (Amir et al., 2013) have advanced techniques for quantifying supply chain resilience. This paper is intended to contribute to this advancement.

The objective of this study is to examine the mediating impact of *Halal* Logistics towards the relationship between resilience predictor variables (capabilities and vulnerabilities) and supply chain resilience.

2. REVIEW OF LITERATURE

Agency theory, is concerned with the governance and control mechanism structure of firms to mitigate the occurrence of conflicting interests, asymmetry of information and non-alignment of goals between the principal and the Agent. As described by Perrow, agency theory assumes that social life is a series of contracts (Perrow, 1986). The principal is the delegating authority who acts as the customer in need of goods and/or services; while the Agent is the contractor, who is the provider of the goods or service.

As reported by Shapiro (2005), of foremost note in the principal-agent relationship is the incompatibility and non-alignment of goals. The cost borne by the principal, in monitoring the agent is usually huge, and most times, the principal is usually limited in their capability to monitor and judge the agent's involvement. This is where third party agent control becomes important.

Control involves having robust and effective policies and monitoring mechanisms to help ensure the proper procedures and processes are adhered in the supply chain events. In the supply chain relationship, each participant receives inputs from a set of suppliers, processes the inputs and delivers them to a different set of customers as the next custodians in the supply chain. By virtue of these relationships, each participant at some point acts as a principal, and at other point acts as an agent in the supply chain. Hence the existence of multiple principals and multiple agents in the supply chain. This logic is strengthened by Deloitte (2012) assertion that having a mechanism of control to mediate these relationships, is an essential component of supply chain resilience.

The control mechanism in itself acts as an agent of co-ordination. This is achieved by regulation of the supply chain interactions and the logistics events in a way that value is sustained along the supply chain. This is also in agreement with Sheffi and James (2005), who reported that extent of value reduction and the speed of restoration to normal operation is a reflection of the degree of supply chain resilience.

Shapiro's essay on agency theory, throws more light on the risk profile of the participants in a supply chain - Principals are risk neutral, and Agents are risk averse (Shapiro, 2005). The Agents are risk neutral because they have a diversified risk portfolio, while the principals are risk averse because they have a "stand-alone" undiversified risk portfolio. In order for them (principals and agents) to protect themselves from any unforeseen risk events, they would undertake measures contrary to each other's interest. This results in the non-alignment of strategies and goals.

A supply chain however, is not made up of mere participants but partners. This is due to the nature of the multiple principal-agents relationships in the supply chain, resulting in a reversal and interchange of principal-agent roles at each point. Essletzbichler (2003) in his study on "The sectoral and geographical extent of contract work in US manufacturing" reported that globalization and the associated increase in the length and complexities of the supply chain has brought a new dimension to the integration of the supply chains. Due to the increase in the networks and high interdependence between supply chain partners, a potential for unforeseen risks and disruptions is created.

A disruption at an early point in the supply chain network can create a rippling effect and cause a negative feedback at another point in the network and this may be further compounded by import/export boundaries, in the case of international integration. This dimension of vulnerability in the supply chain was defined by Pettit et al. (2008), as "connectivity" (the degree of interdependence and reliance on outside entities). In order to mitigate this vulnerable effect, the supply chain partners need to work effectively through symbiotic, honest relationships (Pettit et al., 2008; Aigbogun et al., 2014; Alamer et al., 2015; Aigbogun et al., 2015; Qureshi et al., 2015). This is a supply chain capability defined by Muckstadt and Murray (2000) as "collaboration" i.e., those activities between supply chain partners concerned with the cost effective, timely, and reliable movement of materials to satisfy customer requirements.

Collaboration goes beyond a supplier (principal) and receiver (agent) relationship. It entails that a joint working relationship be maintained at all points in the supply chain. Muckstadt and Murray (2003), as well as Bakshi (2008), assert that collaboration between supply chain partners is best achieved by cooperation, planning and joint decision making. Findings from studies (Le and Koh, 2002; Pettit et al., 2008; Amir et al., 2013; Aigbogun, et al., 2014) report that Collaboration improves supply chain performance, mitigates the risk burden and builds resilience into the supply chain.

According to Christopher and Lee (2004), collaboration among supply chain partners aids in the tracking and monitoring of supply chain events and patterns as they happen. This is referred to as visibility in the supply chain. Visibility is the knowledge of the status of operating assets and the environment (Pettit et al., 2008). Supply chain visibility is improved when the principals and agents act as by sharing information, hence enabling supply chain partners to proactively address issues before they become problems.

The fundamental idea behind the agency theory is that the principal is too busy or do not have adequate expertise to do a given job

and so hires the agent (Perrow, 1986; Alamer et al., 2015). This means that the principal cannot monitor the agent effectively. And the agent cannot be counted on to self-regulate their activities optimally, as each is driven by their self-interests.

In the supply chain where there are multiplicity of principal-agent relationships, it is expected that there will be a conflict of signals, incentives and strategies between partners and reconciling these creates a kind of chaos in the system. The principals may try to influence the agents' action so that they will act in a manner consistent with the principals' interests. This calls for some governance mechanisms or devices for the monitoring of the principal-agent relationships (Shapiro, 2005). This is where the third party *Halal* logistics and assurance control as a regulatory governance mechanism comes into play as agents in the multiple principal-agent model of the pharmaceutical supply chain.

Halal is an important and growing issue of interest in the Malaysian pharmaceutical industry as *Halal* medicines are highly important to the Malaysian market, given that Islam is the country's official religion and majority of the consumers are Muslims. As such, many medicines - for example those compounded in capsules with the animal product gelatin - cannot be consumed by many observant Muslims. *Halal* is not just a purely religious issue; It is also in the realm of business and trade (Borzooei and Asgari, 2013). Pharmaceutical companies have been aware of this niche for some time, but it is only recently that pharmaceutical companies have explicitly targeted this growth area (BMI, 2010).

Tieman et al. (2012), in their research on "Principles in *Halal* supply chain management" have described *Halal* logistics as procedures that ensure product quality in the procurement and supply chain management of commodities, according to *Halal* prescribed standards. A major theme of this definition of *Halal* logistics is the assurance of quality throughout the length of the supply chain; a property known to confer resilience to the supply chain (Andersson, 2007). In the case of the Malaysian pharmaceutical industry, the *Halal* compliance and regulatory body (JAKIM) is a body wholly responsible for determining *Halal* pharmaceutical standards. It is also responsible for monitoring the quality assurance process starting from the supplier of the raw materials through the logistics process until the end product, including the principles of good manufacturing practice.

Tang (2006), reports that lowering the level of vulnerability of supply chains is one of the most important management strategies. The findings of Tieman et al. (2012) reveal that *Halal* logistics, control and assurance activities are put in place to reduce supply chain vulnerabilities. In a principal-agent model, a governing mechanism is an important tool for achieving this goal (Watterman and Meier 1998).

Therefore we hypothesize that:

H1: *Halal* logistics have mediating effect on the relationship between supply chain vulnerabilities and supply chain resilience in the pharmaceutical industry.

Very importantly, having the regulatory body to assure the management of quality throughout the supply chain helps to strengthen the collaboration and partnership of suppliers and manufacturers to secure continuity of supply (Tieman and Maznah, 2013). This role can also impart the capability of the supply chain in terms of flexibility in sourcing of raw materials according to specifications both by the firms (multiple principal-agent) and the regulatory authority (agents), who have the capacity to source alternative suppliers that meet the quality standards in terms of supply disruptions (Aigbogun et al., 2014).

Therefore we hypothesize that:

H2: *Halal* logistics have mediating effect on the relationship between supply chain capabilities and supply chain resilience in the pharmaceutical industry.

Also according to Tieman and Maznah (2013), conventional commodity categories in certain industries can be differentiated for *Halal* certified products and services. This capability thus show that *Halal* logistics and regulatory assurance has an impact on the purchasing process; as well as its tactical and operational purchasing activities using the purchasing portfolio matrix of Kraljic and the purchasing process model of van Weele.

3. METHODOLOGY

By means of Grounded theory methodology approach from the managerial perspective, the underlying Capabilities and vulnerabilities of the Malaysian pharmaceutical manufacturing industry supply chain were extracted (Aigbogun et al., 2014).

In the present study, cross sectional primary data has been gathered from a field survey in which structured type questionnaires were self-administered directly to the target research population. In total, 60 respondents from 10 pharmaceutical companies operating *Halal* supply chain have been surveyed. According to Peck (2005), "no one person manages the whole supply chain." Therefore, multiple respondents at the managerial level from critical functional areas (logistics/scheduling/planning, research and development, purchasing/procurement, quality assurance) of each organization supply chain have been recruited. This have been done in agreement with Pettit et al. (2008), as well as Mahbubul and Rafikul (2013), in order to reduce individual bias, while efficiently encompassing the breadth of issues relating to supply chain resilience.

The SCRAM© 2.0 developed by The Centre for Resilience, Ohio State University (Pettit et al., 2008) has been adopted and adapted for this study. The questionnaire is divided into two sections. Section A and Section B. The section A contains items to provide the demographic profile of the respondents as well as their organizations. This is necessary in order to assess the suitability of the respondents taking part in the survey, as well as their authority, professional experience and knowledge of their organizations product and supply chain operations.

Section B contains items categorized according to the dimensions of supply chain vulnerabilities (4), capabilities (6) and *Halal*

logistics (3). The responses have been anchored on a four point Likert's scale ranging from 1 - Strongly disagree; 2 - Disagree; 3 - Agree; 4 - Strongly agree. A mid-point/neutral response is avoided so that respondents do not mistake it for "I do not know" or "not available." It is preferable the respondents make a definite choice rather than choosing a neutral position. This is in agreement with Raaijmakers et al. (2000) and Oluka et al. (2013).

The unit of observation is the individual, while the unit of analysis is organizational. The mean of the aggregated responses from multiple respondents within the same organization has been reported per organization. The respondents and organizations are assured of their rights to privacy and confidentiality of information. $R = \dfrac{C - V + 1}{2}$

Resilience has been calculated from the formula; where R = Resilience; C = Capabilities, V = Vulnerabilities (Pettit et al., 2008; Amir et al., 2013). The responses from the respondents have been quantified using fuzzy analytical hierarchy process (AHP) approach for prioritization and measurement (Aggarwal and Singh, 2013). AHP evaluations are based on the assumption that the decision maker is rational.

A fuzzy spectrum consisting of triangular fuzzy scales by Aggarwal and Singh (2013) that corresponds to the 4 point Likert scale was used (Table 1 and Figure 1).

In accordance with Amir et al. (2013), fuzzy mean and spread method (Azar and Faraji, 2010) have been used for defuzzification. The fuzzy number M = (l, m, u) is defuzzified as: (l+2m+u)/4 (fuzzy mean and spread method) and standardized (Chiang, 2010). The crisp values are then entered into SPSS.

Figure 1: Triangular fuzzy scales corresponding to the Likert scale
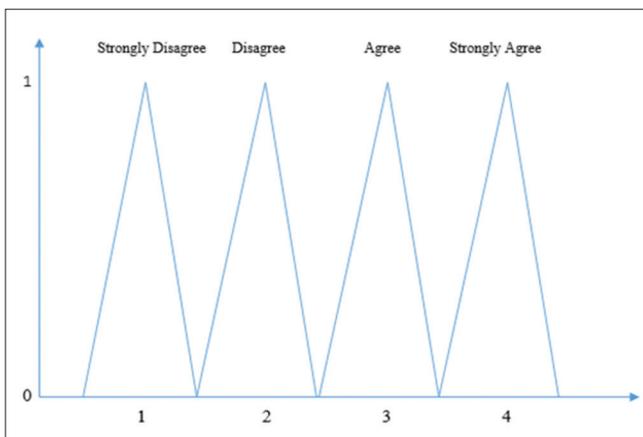
Source: Aggarwal and Singh (2013)

Table 1: Triangular fuzzy scales corresponding to the Likert scale

Responses	Strongly disagree	Disagree	Agree	Strongly agree
Crisp numbers	1	2	3	4
Triangular fuzzy numbers (l, m, u)	(2/3, 1, 3/2)	(3/2, 2, 5/2)	(5/2, 3, 7/2)	(7/2, 4, 9/2)

Source: Aggarwal and Singh (2013)

Inferential statistics have used to analyze the quantitative data and test the research hypothesis. Pearson's correlation analysis is used to examine the direction, strength and significance of relationships between the predictors, mediating and outcome variables.

Norman (2010), Argues that "parametric statistics can be used with Likert data, with small sample sizes, with unequal variances, and with non-normal distributions, with no fear of coming to the wrong conclusion." Parametric statistics are perfectly appropriate. Hence, after significant correlations have been established, multiple regression analyses were performed.

4. RESULTS

The following results have been attained from the data analysis:

4.1. Demographic Characteristics of Survey Respondents
In respect to the critical functional areas of the supply chain, out of a total number of respondents (N = 60) that have taken part in the survey, 26 are from purchasing department making up 43.3% of the total number of respondents. 25 (41.7%) are from the logistics/planning/scheduling department. 7 (11.7%) of the respondents are from the quality assurance department while 2 (3.3%) respondents from research and development department have taken part in the field survey.

In respect to the job designation of the survey respondents, out of a total number of respondents (N = 60) that have taken part in the survey, 13 are general managers making up 21.7% of the total number of respondents. 22 (36.7%) are departmental heads. 20 (33.3%) of the respondents occupy senior executive positions in their various departments, while 5 (8.3%) occupy junior executive positions in their various departments.

As regards the length of service and professional experience in their present role, the following responses were gathered. 2 of the respondents have spent less than two years in their present role making up 3.3% of the total survey population (N = 60). 6 (10%) respondents have spent between 2 and 5 years in their present role. 30 (50%) of the respondents have spent between 6 and 10 years of professional experience in their present role, while 22 (36.7%) respondents have over 10 years of professional experience in their present roles.

All the organizations that have taken part in the survey are pharmaceutical companies who engage in the manufacture of *Halal* pharmaceutical products.

4.2. Fuzzy Values of Responses
There are four vulnerability dimensions - Turbulence (V1-1 to V1-6), external pressures (V2-1 to V2-6), sensitivity (V3-1 to V3-7) and connectivity (V4-1 to V4-7).

Consequently, there are six capability dimensions - Flexibility (C1-1 to C1-5), visibility (C2-1 to C2-7), collaboration (C3-1 to C3-8), adaptability (C4-1 to C4-5), capacity (C5-1 to C5-5) and supplier dispersity (C6-1 to C6-4).

The fuzzy values of capability and vulnerability responses have been used to calculate the resilience for each organization. The indexes assigned, corresponds to the number of items under each dimension. The responses of the respondents (N = 60) have been collected for each index, and the indexes are then used to calculate the quantitative fuzzy values using triangular fuzzy AHP numbers. The fuzzy mean was then obtained as the value of each dimension of vulnerabilities (V1, V2, V3, and V4) and capabilities (C1, C2, C3, C4, C5 and C6). Fuzzy mean is used with the assumption that there are "m" indexes in each dimension.

Furthermore, the fuzzy AHP numbers of each dimension of vulnerabilities (V1, V2, V3, and V4) and capabilities (C1, C2, C3, C4, C5 and C6) are then aggregated and their mean value reported as the overall values for vulnerabilities (V) and capabilities (C) for each organization.

The defuzzified mean values for vulnerabilities (V) and capabilities (C) are then used to calculate the resilience for each organization (Table 2).

The resilience values obtained for each organization are then entered into SPSS and then recoded into different variables in order to carry out further statistical tests (bivariate correlations and multiple regression) on the research model.

4.3. Bivariate Correlations
The result of the Pearson's correlation is displayed in the Table 3.

The direction of the correlation has been measured by their negative or positive Pearson's correlation value. The significance of the correlation (P value) is measured at the 0.10 level. The

Table 2: Resilience value for each organization

Organizations	Indexes	Fuzzy AHP numbers (l, m, u)	Defuzzification with fuzzy mean/spread (l+2m+u)/4	Resilience $R = \dfrac{C - V + 1}{2}$ (%)
A	C	(2.67, 3.17, 3.67)	3.17	0.71 (71)
	V	(2.25, 2.75, 3.25)	2.75	
B	C	(2.83, 3.33, 3.83)	3.83	0.67 (67)
	V	(3, 3.5, 4)	3.50	
C	C	(3.33, 3.83, 4.33)	3.83	0.67 (67)
	V	(3, 3.5, 4)	3.50	
D	C	(3.5, 4, 4.5)	4.00	0.50 (50)
	V	(3.5, 4, 4.5)	4.00	
E	C	(3.5, 4, 4.5)	4.00	0.75 (75)
	V	(3, 3.5, 4)	3.50	
F	C	(2.83, 3.33, 3.83)	3.30	0.40 (40)
	V	(3, 3.5, 4)	3.50	
G	C	(3.25, 3.75, 4.25)	3.75	0.86 (86)
	V	(2.5, 3, 3.5)	3.00	
H	C	(3.25, 3.75, 4.25)	3.75	0.86 (86)
	V	(2.5, 3, 3.5)	3.00	
I	C	(3.25, 3.75, 4.25)	3.75	0.79 (79)
	V	(2.67, 3.17, 3.67)	3.17	
J	C	(2.75, 3.25, 3.75)	3.25	0.625 (62.5)
	V	(2.5, 3, 3.5)	3.00	

C: Capabilities, V: Vulnerabilities

Table 3: Correlation matrix

Pearson's rho	Resilience	Vulnerabilities	Capabilities	*Halal* logistics
Resilience				
Correlation coefficient	1.000	−0.545**	0.659**	0.619**
Significant (two-tailed)		0.026	0.000	0.000
N	10	10	10	10
Vulnerabilities				
Correlation coefficient	−0.545**	1.000	0.039	−0.181
Significant (two-tailed)	0.026	-	0.768	0.066
N	10	10	10	10
Capabilities				
Correlation coefficient	0.659**	0.039	1.000	0.492**
Significant (two-tailed)	0.000	0.768	-	0.000
N	10	10	10	10
Halal logistics				
Correlation coefficient	0.619**	−0.181	0.492**	1.000
Significant (two-tailed)	0.000	0.066	0.000	-
N	10	10	10	10

**Correlation is significant at the 0.01 level (two-tailed)

strength of the correlation coefficient has been measured according to Cohen (1998) as seen in the Table 4.

The following relationships were analyzed and the results are as follows:
- Capabilities and resilience (r = 0.659, P = 0.000)
- Vulnerabilities and resilience (r = −0.545, P = 0.026)
- Capabilities and *Halal* logistics (r = −0.492, P = 0.000)
- Vulnerabilities and *Halal* logistics (r = −181, P = 0.066)
- *Halal* logistics and resilience (r = 0.619, P = 0.000).

From the values obtained it can be noticed that capabilities positively impacts the resilience of the supply chain while vulnerabilities negatively impacts the resilience of the supply chain. Also, significant relationships exists between each of the predictors (capabilities, vulnerabilities) and outcome (resilience). Significant relationships also exists between each of the predictors (capabilities, vulnerabilities) and mediator (*Halal* logistics), as well as mediator (*Halal* logistics), and outcome (resilience).

Also, observing the correlation values between the predictors reveal no issue of multicolinearity.

4.4. Regression Model

Multiple regression analysis has been used as the statistical technique for testing the research hypothesis.

H1: *Halal* logistics have mediating effect on the relationship between supply chain vulnerabilities and supply chain resilience in the pharmaceutical industry.

H2: *Halal* logistics have mediating effect on the relationship between supply chain capabilities and supply chain resilience in the pharmaceutical industry.

Multiple regression analysis is useful for measuring and testing the differential effects of the mediator (*Halal* logistics). The information gathered from multiple regression analysis can act as a forecasting technique by reducing raw data to actionable information, thereby offering a scientific angle to the management of the supply chain.

Tables 5 and 6 show the model summary and the regression coefficients table respectively.

As observed from Table 5 above (model summary), the main effect of capabilities and vulnerabilities (R^2 change - Model 1) accounted for 0.553 (55.3%) of the variance in the resilience of the supply chain which was significant (Significant F Change = 0.000).

Furthermore, when *Halal* logistics is added (Model 2), it accounts for an additional 0.161 (16.1%) variance in the Resilience of the supply chain which was significant (significant F change = 0.000) too.

Simultaneous entry has been used which allows for controlling the effect of the predictors (vulnerabilities and capabilities) while the effect of the mediator (*Halal* logistics) on resilience (outcome) was examined.

The results (Table 6) is then compared; that is the relative effect of vulnerabilities and capabilities on supply chain resilience when *Halal* logistics is controlled, to the effect of vulnerabilities and capabilities on supply chain resilience when *Halal* logistics is not controlled.

To test the hypothesis 1 (H1), the effect of the mediator (*Halal* logistics) on the relationship between vulnerabilities and resilience was calculated. The Table 6 shows for coefficients, there is a partial

Table 4: Strength of correlation coefficients

Correlation coefficient (r)	Relationship strength of the variables
0.10-0.29	Small
0.30-0.49	Medium
0.50-1.0	Strong/large

Source: Cohen (1998)

Table 5: Regression model summary

Model	R	R^2	Adjusted R^2	Std. error of the estimate	Change statistics				
					R^2 Change	F Change	df1	df2	Significant F change
1	0.744[a]	0.553	0.537	0.47005	0.553	35.280	2	7	0.000
2	0.845[b]	0.714	0.699	0.37913	0.161	31.616	1	6	0.000

[a]Predictors: (Constant), capabilities, vulnerabilities, [b]Predictors: (Constant), capabilities, vulnerabilities, *Halal* logistics

Table 6: Regression coefficients[a]

Model	Unstandardized coefficients		Standardized coefficients	t	Significant
	B	Standard error	Beta		
1					
(Constant)	1.169	0.622		1.878	0.065
Vulnerabilities	−0.601	0.123	−0.435	−4.906	0.000
Capabilities	0.982	0.140	0.621	7.004	0.000
2					
(Constant)	0.726	0.508		1.429	0.159
Vulnerabilities	−0.443	0.103	−0.321	−4.314	0.000
Capabilities	0.612	0.131	0.386	4.672	0.000
Halal logistics	0.399	0.071	0.476	5.623	0.000

[a]Dependent variable: Resilience

mediation since the value of vulnerabilities is significant in Model 1 and still significant in Model 2. The coefficient is lowered from −0.453 to −0.321 which indicates that *Halal* logistics influences the relationship. According to the guidelines by Baron and Kenny (1986), these results suggest that there is a partial mediation effect on supply chain resilience. Therefore null hypothesis is rejected.

This is in agreement with the hypothesis 1 - H1: *Halal* logistics have mediating effect on the relationship between supply chain vulnerabilities and supply chain resilience in the pharmaceutical industry.

To test the hypothesis 2 (H2), the effect of the mediator (*Halal* logistics) on the relationship between capabilities and resilience is calculated. The results show that there is a partial mediation since the value of capabilities is significant in Model 1 and still significant in Model 2. The coefficient is lowered from 0.621 to 0.386 which indicates that *Halal* logistics influences the relationship. According to the guidelines by Baron and Kenny (1986), these results suggest that there is a partial mediation effect on supply chain resilience. Therefore null hypothesis is rejected.

These results are consistent with hypothesis 2 - H2: *Halal* logistics have mediating effect on the relationship between supply chain capabilities and supply chain resilience in the pharmaceutical industry.

5. CONCLUSION

The cause and effect relationships between supply chain capabilities and supply chain vulnerabilities on supply chain resilience with the application of *Halal* logistics as a regulatory and governing mediator in the multiple principal-agent relationships has been studied. The findings help to strengthen our understanding of the subject matter by specifying the conditions under which the relationships between the predictors and outcomes are significant. This is an aspect that has previously not been explored. For academic body of knowledge, the study findings adds valuable knowledge to the literature.

Since multiple principals and multiple agents exist in the supply chain, it is expected that the governing mechanism which acts in itself as an Agent in the relationship be able to neutralise the chaos, parallel interests and information asymmetries that exist within the overall supply chain framework. This study findings has proven this. Also, a major element of MalaysiaAlso, athis. Also, aexist in the sup to their information networks. The available information infrastructure, through the multimedia super corridor is a critical strength of the country. This can help strengthen the collaboration between the multiple Principal-Agent relationships which exists in the agency model of the supply chain.

This study is not without its limitations. Firstly, the distributions as well as external validity is a concern as regards the sample size used in this study. Although the size of the sample is more of an issue of judgment rather than statistics, it is believed that with a larger sample size, one can achieve more impactful findings during the conducted statistical testing.

6. ACKNOWLEDGMENT

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