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Reverse Logistics System Influencing Firm Performance in Omni-Channel Supply Chain

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Abstract:
Few researchers have attempted to discover omni-channel from the lens of the supply chain, particularly the logistics perspective. Although focusing predominantly on the supply chain, this study aims to develop a structural relationship model to examine the relationship between reverse logistics and firm performance in the omni-channel environment using Smart-PLS. Many studies examine the reverse logistics factors, but these studies did not discuss reverse logistics in the omni-channel business environment. This study would comprehensively understand reverse logistics systems in omni-channel companies. It also demonstrated the effectiveness of reverse logistics in boosting firm performance. A well-designed reverse logistics system can provide competitive advantages to omni-channel companies. This study used a questionnaire survey to investigate the reverse logistics system of different omni-channel companies, including manufacturers, retailers, and logistics service providers. After that, this study applied structural model analysis and moderation relationships analysis to examine reverse logistics factors. In conclusion, some form factors, such as flexibility and collaboration, apparently have a significant influence on omni-channel firm performance. While looking at the task environment factors, customer and supplier are significant factors in predicting omni-channel firm performance. However, firm factors such as top management support, formalization, and information system, and other task environment factors (such as competitors) act as moderator variables towards reverse logistics instead of being directly related to omni-channel firm performance. The results of this study can guide omni-channel companies in designing systematic reverse logistics programs to help their companies to perform better. Relevant entrepreneurs could develop more effective and efficient programs to support the reverse supply chain by including both firm and task environment aspects to boost company performance. This study reports an empirical survey of the reverse logistics system in an omni-channel environment. It provides a comprehensive understanding of the relationships and impacts of reverse logistics systems on omni-channel firm performance.

Keywords: reverse logistics, omni-channel, firm performance, firm factor, task environment factor.

全渠道供应链的逆向物流系统影响着公司业绩

摘要：
很少有研究人员试图从供应链的角度来发现全渠道，尤其是从物流的角度。尽管主要关注供应链，但本研究旨在开发一个结构关系模型，以使用智能偏最小二乘法检查全渠道环境中逆向物流与公司绩效之间的关系。许多研究考察了逆向物流因素，但这些研究并未讨论全渠道商业环境中的逆向物流。本研究将全面了解全渠道公司的逆向物流系统。它还展示了逆向物流在提高公司业绩方面的有效性。一个设计良好的逆向物流系统可以为全渠道公司提供竞争优势。本研究使用问卷调查来调查不同全渠道公司的逆向物流系统，包括制造商、零售商和物流服务提供商。之后，本研究应用结构模型分析和调节关系分析来检验逆向物流因素。总之，一些形式因素，如灵活性和协作，显然对全渠道公司的绩效有重大影响。在查看任务环境因素时，客户和供应商是预测全渠道公司绩效的重要因素。然而，诸如高层管理支持、正规化和信息系统等企业因素以及其他任务环境因素（如竞争对手）作为逆向物流的调节变量，而不是与全渠道企业绩效直接相关。这项研究的结果可以指导全渠道公司设计系统的逆向物流方案，以帮助他们的公司更好地表现。相关企业家可以通过包括公司和任务环境方面的内容来制定更有效和高效的计划来支持逆向供应链，以提高公司绩效。本研究报告了对全渠道环境中逆向物流系统的实证调查。它全面了解逆向物流系统对全渠道公司绩效的关系和影响。

关键词：逆向物流、全渠道、企业绩效、企业因素、任务环境因素。

1. Introduction

It is common for companies to adopt an omni-channel strategy in their business model (Leu & Masri, 2021). As a result, traditional retailers have entered the digital channels, while e-commerce retailers have begun operating new brick-and-mortar stores (Hübner et al., 2016; Rai et al., 2019). In addition, the Malaysian government has encouraged small and medium-sized enterprises (SMEs) to participate in the omni-channel business environment. Still, they may face challenges because the trend is new to them (Kaur et al., 2019; Mahusni & Abdul Ghafar, 2018). In the reverse supply chain, different elements such as collaboration, information systems, resources commitment, and strategic planning (Bai & Sarkis, 2018; Genchev, 2009; Ho et al., 2012; Huscroft et al., 2013; Mai et al., 2012; Morgan et al., 2016) represent company factors that are being identified as determinants of effective reverse logistics. For supporting an omni-channel business structure, firm factors such as collaboration between different individual departments and information systems are required.

In contrast, the advancement of a reverse logistics system is related to firm factors that could improve company performance. Furthermore, the significance of task environment factors in reverse logistics cannot be overstated. Task environment factors in reverse logistics systems include customers, suppliers, competitors, and regulators (Carter & Ellram, 1998). In past studies, these reverse logistics elements were proved to be significant determinants for reverse logistics systems but have not been investigated in an omni-channel context. Understanding such relationships allows the issues of effective reverse logistics to be identified, and company performance can be improved by cultivating a more positive attitude toward improving company operations and strategic planning. As a result, the gaps in current knowledge and the need for research are summarised. This thesis aims to strengthen the theoretical structure of reverse logistics, which has yet to be explored and examined (Carter & Ellram, 1998).

2. Theoretical Background

Omni-channel companies are those businesses that manage various types of channels (digital and physical) at different phases of the procedure. Manufacturers, digital retailers, physical retailers, and logistics service providers are some examples of omni-channel companies that are widely mentioned (Saghiri et al., 2017). The reverse logistics system is vital in return processes because it will give omni-channel companies an advantage in terms of customer satisfaction and cost optimization. Hübner et al. (2016) conducted exploratory research on distribution systems in omni-channel. Its sources and destination of delivery characterize a distribution system. The following framework, constructed based on expert opinion, provides a comprehensive understanding of the physical flow in omni-channel distribution.

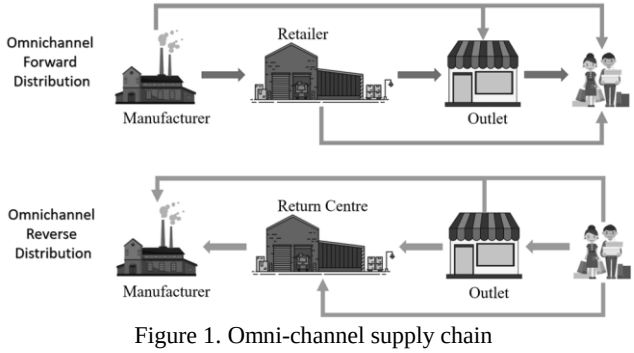

Figure 1. Omni-channel supply chain

Omni-channel businesses have more options for product delivery and collection, as illustrated in the figure above. Customers can receive the product directly from manufacturers or retailers via a courier service in forwarding distribution. Businesses can use distribution centers to fulfill online orders from web

shops and mobile applications. Aside from that, customers can choose to buy in-store or online and pick up in-store. The reverse supply chain in omni-channel implies that different phases and routes are linked together to fulfill the return functions. Hence, information in the reverse supply chain will be flexible, accessible, and identifiable (Saghiri et al., 2017). Information integration improves a company's freedom to predict the appropriate methods for collected material, whether to reuse or recycle it. Companies in omni-channel backward distribution provide customers with various return options, such as return in-store, drop point and courier service. (Bernon et al., 2016). Reverse logistics has become more challenging logistically as the number of channels has expanded. The reverse supply chain is no longer linear; it implies that brick-and-mortar collection is increasingly interchanging with courier service collection (Hübner et al., 2016). In general, reverse logistics is more complex and difficult to predict than forwarding logistics. As a result, a well-organized reverse logistics system is essential to deal with these challenges and ambiguity (Bernon et al., 2016; Tibben-Lembke & Rogers, 2002).

2.1. Firm Factor

An effective reverse logistics system should have top management support, information system, collaboration, flexibility, and formalization (Bai & Sarkis, 2013; García-Sánchez et al., 2018; Genchev et al., 2011; Ho et al., 2012; Morgan et al., 2016). Managers who are aware of the complexity and ambiguity of reverse logistics activities and those who have a positive mindset toward reverse logistics management are crucial to the effectiveness of reverse logistics systems, which could lower costs (García-Sánchez et al., 2018). By formalizing and standardizing procedures, the company can manage reverse logistics activities following stakeholder expectations (Huscroft, 2010). For example, formalized procedures in omni-channel companies can be conducted to determine whether returned goods should be resold, reused, repaired, refurbished, remanufactured, retrieved, or recycled. Furthermore, companies with operational flexibility can focus on ensuring reverse logistics activities like gatekeeping, collection, sortation, and disposition run smoothly (Tombido et al., 2018). Flexibility allows a company to respond quickly to unexpected events and devise creative solutions (Bai & Sarkis, 2013). Flexibility necessitates the coordination of multiple levels of management within and across organizations. In reverse logistics operations, companies must also use information systems to manage the complexity and speed up the procedure (García-Sánchez et al., 2018). For instance, a company can organize a reverse logistics operation based on a historical database forecasting the types and quantities of returns. Collaboration was defined by Mai et al. (2012) as a synergistically shared process within a company in which two or more departments demonstrate mutual understanding and a shared vision while also closely cooperating to achieve common goals. In a study by Hernández et al. (2011), the importance of information sharing in reverse flow planning, such as collection channels, was highlighted.

2.2. Task Environment Factor

According to previous research, omni-channel companies' reverse logistics systems must also account for external influences such as suppliers, customers, regulators, and competitors (Abdullah & Yaakub, 2015; Carter & Ellram, 1998; Huang et al., 2016; Mills, 2007; Ye et al., 2013). Companies collaborating with suppliers in reverse supply chain processes, intra- or inter-organizational, can enhance performance by fostering stronger relations (Vlachos, 2016). Companies that connect with suppliers could be capable of reducing the bullwhip effect, which leads to wasteful resource allocation and poor planning. Besides, a company that can identify and responds to customer demands has a better chance of surviving in a highly competitive environment (Vlachos, 2016). In addition, Ye et al. (2013) also stated that paying attention to the customer has always been a key business criterion. However, some researchers have discovered that the regulator impacts task environment factors in the company's reverse logistics management. (Carter & Ellram, 1998). The regulator can control and formulate laws and regulations to influence an organization's policies and strategies (Huang & Yang, 2014; Lau & Wang, 2009). In reality, a company may unintentionally try to mimic the strategies of other members. (Ye et al., 2013). A company will follow in the footsteps of another that it perceives as the industry leader. Companies may attempt to replicate the reverse logistics strategies of more successful rivals (Huang & Yang, 2014). These studies looked at various aspects of a company's reverse logistics system that could affect its performance. The emergence, on the other hand, is not well captured. As a result, a study of the reverse logistics systems of companies operating in the omni-channel environment is required.

3. Method and Materials

This study is a survey-based project. A quantitative research method, the questionnaire, has been used for data collection from the sample randomly to test the hypotheses. The questionnaires are primarily sent to the respondents through the internet and mail. In order to design the questionnaire, an extensive search of previous articles related to the reverse supply chain was conducted. That ensures the questionnaire design in this quantitative stage is reliable for this study. Therefore, the instruments in the questionnaire (Table 1) are captured from previous empirical studies that had to go through reliability and validity testing.

Table 1. Measurement items for each variable

Variables	Operational Definition
Top Management Support: 1) Our top managers recognize the importance of returns management implementation. 2) Our top managers proactively support returns management implementation. 3) Our top managers are willing to invest the resources needed to implement returns management. 4) Our top managers substantially influence our company's returns management implementation. Sources: (Richey et al., 2005; Shafiq & Naqvi, 2012; Ye et al., 2013)	Degree of support from top management toward reverse logistics management
Formalization: 1) The job description of related practitioners in returns management is clearly stated. 2) The hierarchy of authority in returns management is clearly stated. 3) Returns management's standard operating procedures (SOP) are clearly stated. 4) There are standard methods for employees to transfer information to other relevant persons. Sources: (Dahlstrom et al., 1996; Hall & Johnson, 2016; Tiwari, 2013)	Clear instructions and definitions of reverse logistics activities and responsibilities for control and practices in reverse logistics management
Flexibility: 1) My firm can handle difficult and nonstandard return requests. 2) My firm can authorize and perform special requests made by customers. 3) My firm can cover and handle different volumes of returns regardless of small or large capacities. 4) My firm can cover and handle return requests from different channels. Sources: (Bai & Sarkis, 2013; Nair, 2005; Stevenson & Spring, 2009; Um, 2017)	The capacity and capability of reverse logistics systems efficiently respond to complexities and uncertainties in the reverse flow
Information System: 1) Information systems enable information sharing with all departments inside the company. 2) Information systems enable the planning of returns effectively. 3) Information systems enable faster product return handling in my company. 4) Information systems enable us to track products easily. 5) Information systems reduce errors while handling transactions during the product return process. Sources: (Daugherty et al., 2005; Mahindroo et al., 2018b; Olorunniwo & Li, 2010)	The capability of information systems used in the reverse logistics system
Collaboration: 1) Different departments in my company work together to achieve the goals of returns management. 2) Different departments in my company have a mutual understanding of responsibilities in returns management. 3) Different departments in my company work together as a team in returns management. 4) Different departments in my company conduct joint planning to anticipate and solve operational problems for returns management. Sources: (Richey et al., 2005; Stank et al., 1999b)	The synergistically shared process within a firm where two or more departments closely work together in a reverse logistics system
Customer: 1) My firm adopts returns management to fulfill the requirement of most of the customers. 2) My firm adopts returns management to protect consumer rights provided by the government. 3) My firm design returns management operations based on customer information and requirement. 4) My firm has a good sense of how our customers value our services. 5) My firm believes that this business exists to serve customers. Sources: (Eltayeb and Zailani, 2011; Ye et al., 2013)	The company's capability recognizes and reacts to the customer's influence.
Competitor: 1) The intense competition has strongly pressured our company's returns management strategies. 2) Our competitors' earlier implementation of returns management provides a benchmark and guidance for our company's returns management. 3) Competitors have a strong influence on our company's returns management. 4) Competitors with well-developed returns management are perceived favorably in our industry. 5) Our competitors are using returns management to their advantage. Sources: (Chu et al., 2017; Wu et al., 2012; Ye et al., 2013)	The capability of the company recognizes and react to the influence of the competitor
Regulatory: 1) Through the collection of returns, my firm tries to reduce or avoid the threat of current government legislation. 2) Through the collection of returns, my firm tries to reduce or avoid the threat of future government legislation. 3) Regulations in other countries, such as Europe, Japan, and the USA, induced my firm to collect rejected products. 4) The government imposes many regulations or restrictions on my firm's industry. Sources: (Abdullah & Yaakub, 2015; Eltayeb & Zailani, 2011; Hsu et al., 2013)	The capability of the company recognizes and react to the influence of the regulatory
Supplier: 1) There are well-defined goals, scope, and responsibilities between the supplier and our firm in returns management. 2) We maintain long-term cooperative relationships with our suppliers in returns management. 3) Our managers participate in joint planning sessions with suppliers in returns management. 4) My firm effectively shares return information externally with suppliers. 5) My firm experiences improved performance by integrating returns management with suppliers. Sources: (Danese, 2013; Jeszka, 2014; Morgan et al., 2016; Olorunniwo & Li, 2010)	The capability of the company recognizes and react to the influence of the supplier
Omni-channel Firm Performance: 1) Achieve cost reduction	Perceptions of company performance are measured

2) Environmental regulatory compliance 3) Improve customer relationship 4) Improve profitability 5) Reduced inventory cost or investment 6) Improve the company's reputation	against cost, customer relationship, profit, and reputation.

Sources: (Abdullah & Yaakub, 2015; Autry et al., 2001; Daugherty et al., 2005; Huang et al., 2015; Vlachos, 2016; Ye et al., 2013)

Overall, the structure of the questionnaire can be differentiated into four parts: background information, firm factors, task environment factors, and omni-channel firm performance. In order to improve the credibility of the questionnaire approach, a pilot study is conducted with industry experts and university lecturers. Additionally, the pilot test is relevant as the respondents' comments help enhance the study's credibility.

3.1. Respondent Sampling and Profiles

This study applies a stratified random sampling strategy in which the questionnaire is distributed to different groups in the population, such as manufacturers, retailers, and logistics service providers. This sampling strategy could ensure that all categories are included in the study rather than only collecting data from certain types of omni-channel companies. In addition, using a stratified random sampling strategy could minimize the bias in representing the population of this study (Neuman, 2002). There are 112 (25.0%) respondents working in the manufacturer enterprise, 228 (50.9%) respondents working in the retailer enterprise, and 108 (24.1%) respondents working in the logistics service provider enterprise. The data has shown that most respondents work in retail enterprises, similar to the economic census (Department of Statistics Malaysia, 2017). Table 2 shows the respondents' profiles, including the company's role, working position, experience, and firm size.

Table 2. Demographic of respondents (n=448)

	n	Percent (%)
Role of Company		
Manufacturer	112	25.0
Retailer	228	50.9
Logistics Service Provider	108	24.1
Respondent's Working Position		
Top Management	1	0.2
Senior Manager	6	1.3
Manager	29	6.5
Senior Executive	220	49.1
Executive	192	42.9
Working Experience		
1 - 5 years	31	6.9
6 - 10 years	209	46.7
11 - 15 years	9	2.0
16 - 20 years	173	38.6
21 - 30 years	24	5.4
above 31 years	2	0.4
Firm Size		
Micro	39	8.7
Small	183	40.8
Medium	221	49.3
Large	5	1.1
Total	448	100

4. Analysis and Results

Anderson and Gerbing (1991) used a 2-step approach to test the measurement model. First, we tested the measurement model by examining the validity and reliability of the instruments based on Hair *et al.* (2019). Then, the study will continue with the structural model to conduct hypothesis testing. In order to ensure the measurement model is reliable and valid, this study must examine the loadings, average variance extracted (AVE), and composite reliability (CR) (Hair et al., 2019; Ramayah et al., 2018). The assessment standard in this study includes factor loadings of the indicators greater than 0.5, composite reliability (CR) of the various dimensions greater than 0.7, and Average Variance Extracted (AVE) greater than 0.5. However, AVE less than 0.4 is acceptable as Fornell and Larcker's (1981) criterion mentioned that the convergent validity of the instrument would be sufficient if the AVE is less than 0.5 but CR is more than 0.6. From Table 3, the results show that all the AVEs are more than 0.5 except for customer and omni-channel firm performance. However, the CR of the customer and omni-channel firm performance is more than 0.7, which is considered acceptable by the convergent validity of both constructs. The loadings of each construct are shown in the table below, and they are greater than standard 0.5. This study will also look at the composite reliability (CR) to verify the internal consistency of scale items. The CRs of each construct range from 0.778 to 0.927, which are adequate given that the standard is 0.7, as suggested by (Hair et al., 2019). Hence, the data of this result have convergent validity because all of the requirements met the researchers' guidelines mentioned above.

Table 3. Measurement model

Constructs	Items	Loadings	CR	AVE
Collaboration	COL1	0.843	0.801	0.575
	COL3	0.720		
	COL4	0.704		
Competitor	COM1	0.602	0.853	0.542
	COM2	0.609		
	COM3	0.790		
	COM4	0.771		
	COM5	0.870		
Customer	CUS1	0.679		
	CUS2	0.533		
	CUS3	0.666	0.778	0.778
	CUS4	0.671		
	CUS5	0.656		
Flexibility	FLE2	0.762		
	FLE3	0.774	0.809	0.586
	FLE4	0.759		
Formalization	FOR1	0.842	0.876	0.640

	FOR2	0.701		
	FOR3	0.790		
	FOR4	0.857		
Information System	IS1	0.872	0.815	0.535
	IS2	0.577		
	IS3	0.870		
	IS5	0.538		
Regulator	REG1	0.870	0.889	0.669
	REG2	0.818		
	REG3	0.702		
	REG4	0.871		
Supplier	SUP1	0.872	0.787	0.558
	SUP3	0.585		
	SUP5	0.756		
Top Management Support	TMS1	0.856	0.927	0.761
	TMS2	0.837		
	TMS3	0.899		
	TMS4	0.896		
Omni-channel Firm Performance	OFP1	0.736	0.783	0.421
	OFP2	0.681		
	OFP3	0.627		
	OFP5	0.619		
	OFP6	0.569		

Note: COL2, FLE1, IS4, SUP2, SUP4, and OFP4 were deleted due to low loadings.

This study will continue to assess discriminant studies using Fornell and Larcker's (1981) criterion. Based on Fornell and Larcker, the discriminant validity can be defined by two criteria: correlation coefficient between two constructs less than 1 and correlation coefficient of two constructs less than Cronbach's α reliability dimensions. The result of this study showed that the correlation coefficient of the two dimensions is less than 1, which is consistent with the standards set by the previous studies. Furthermore, the correlation coefficient of one measure is greater than the rest of the other measures, which fulfills the second criterion, as shown in Table 4.

Table 4. Fornell Larcker Criterion

Fornell Larcker Criterion										
	1	2	3	4	5	6	7	8	9	10
1.Collaboration	**0.758**									
2.Competitor	0.129	**0.736**								
3.Customer	0.478	0.043	**0.643**							
4.Flexibility	0.534	-0.010	0.580	**0.765**						
5.Formalization	0.133	0.619	-0.010	0.020	**0.800**					
6.Information System	0.121	0.425	0.147	0.163	0.178	**0.732**				
7.Omnichannel Firm Performance	0.480	0.123	0.513	0.529	0.132	0.164	**0.649**			
8.Regulator	0.136	0.571	0.014	0.010	0.736	0.125	0.154	**0.818**		
9.Supplier	0.583	0.074	0.556	0.547	0.100	0.169	0.501	0.109	**0.747**	
10.Top Management Support	0.081	0.180	0.092	0.171	0.070	0.425	0.141	0.017	0.097	**0.872**

4.1. Structural Model

Although PLS-SEM does not require normality, this study will still assess the multivariate skewness and kurtosis using the guidelines from Hair *et al.* (2017) and Cain *et al.* (2017). The application of visual inspection normality may be insufficient for multivariate normality. So, this study will further inspect the multivariate normality using the web application suggested by Ramayah *et al.* (2018). By using the web application (Cain et al., 2017), the analysis showed that the data is not multivariate normal from Mardia's multivariate skewness (β = 61.459, $p < 0.01$) and Mardia's multivariate kurtosis (β = 244.115, $p < 0.01$). Hence, this study will use a 5,000-resampling bootstrapping procedure to obtain the structural model's path coefficients, standard errors, t-values, and p-value (Ramayah et al., 2018). This study will include p-values ($p < 0.05$, as significant), confidence intervals, and effect sizes for testing the hypothesis, as p-values alone would not be a good standard for testing the hypothesis (Hahn & Ang, 2017). The results of hypothesis testing are shown in the Table 5.

Table 5. Hypothesis testing

	Std Beta	**Std Error**	**t-value**	**p-value**
TMS > OFP	0.044	0.044	1.013	0.156
FOR > OFP	0.013	0.063	0.209	0.417
FLE > OFP	0.234	0.062	3.800	*0.000*
IS > OFP	0.013	0.049	0.274	0.392
COL > OFP	0.141	0.067	2.091	*0.018*
SUP > OFP	0.150	0.060	2.480	*0.007*
CUS > OFP	0.219	0.060	3.665	*0.000*
REG > OFP	0.096	0.062	1.552	0.060
COM > OFP	0.010	0.055	0.185	0.427

In the beginning, the analysis will focus on the effect of 9 variables on omni-channel firm performance. The results show that R2 is 0.405 (Q2 = 0.148), which indicates that the 9 variables could be explained by 40.5% of the variance in omni-channel firm performance. Flexibility (β = 0.234, $p < 0.05$), Collaboration (β = 0.141, $p < 0.05$), Supplier (β = 0.150, $p < 0.05$) and Customer (β = 0.219, $p < 0.05$) were shown to have a significant positive relationship with omni-channel firm performance. So, it can be concluded that H3, H5, H6, and H7 were supported. However, Top Management Support (β = 0.044, $p > 0.05$), Formalization (β = 0.013, $p > 0.05$), Information System (β = 0.392, $p > 0.05$), Regulator (β = 0.060, $p > 0.05$), and Competitor (β = 0.010, $p > 0.05$) were not significant factors toward omni-channel firm performance as the p-values were not significant. So, the results showed that H1, H2, H4, H8, and H9 were not supported.

The PLS measurement model revealed that firm factors (flexibility and collaboration) and task environment factors (supplier and customer) significantly influence omni-channel firm performance. Simultaneously, it has been demonstrated that some firm factors (top management support, formalization, and information system) and task environment factors (regulator and competitor) have no significant influence on omni-channel firm performance. With results from previous studies taken into account, this research also aims to examine the effect of more than one variable on the same item in combination, such as the impact of firm factors with task environment factors or vice versa. That could better explain the role of predictive variables. Furthermore, Jalil et al. (2016) emphasized the existence of a symbiosis effect or an integrated

effect between internal and external elements, which would better explain the influence of the reverse logistics system. Hence, moderation analysis was conducted to identify these firm factors and task environment factors that act as moderators instead of a direct causal relationship. A moderator is a variable that can influence and change the relationship and strength between the independent and dependent variables (Henseler & Chin, 2010).

4.2. Moderation Analysis

The moderation analysis will be conducted using Orthogonalizing Approach (Henseler & Chin, 2010), which is suitable for prediction research. Hence, top management support, formalization, information system, regulator, and competitor were tested as moderators with other independent variables. The result of the moderators' testing is shown in the Table 6.

Table 6. Moderation

	Path Coefficient	Std Error	t-value	p-value
TMS*COL -> OFP	0.135	0.128	2.171	0.015
FOR*CUS -> OFP	0.130	0.131	2.228	0.013
IS*CUS -> OFP	0.100	0.102	2.370	0.009
IS*FLE -> OFP	0.105	0.112	2.290	0.011
COM*CUS -> OFP	0.140	0.145	3.169	0.001
COM*FLE -> OFP	0.105	0.124	2.177	0.015

Overall, the moderation analysis revealed that top management support, formalization, information system, and competitor are moderators in the reverse logistics system. However, the regulator had no direct influence on omni-channel firm performance and did not act as a moderator toward firm performance.

5. Discussion

As the empirical results demonstrated, flexibility and collaboration were found to have a significant influence on omni-channel firm performance. However, other firm factors such as top management support, formalization, and information system had no significant influence in predicting omni-channel firm performance. In the form factor aspect, the moderation analysis result showed that top management support acts as a moderator in the reverse logistics system, thereby moderating the relationship between collaboration and omni-channel firm performance. Top management initiatives to improve reverse logistics capabilities, making the reverse flow more effective and efficient. In particular, top management is essential for directing and organizing employees within reverse logistics operations, which helps to increase performance (Ngesa & Shale, 2017). The same result happened with formalization, which explains its role as a moderator between customer and omni-channel firm performance. Strategic planning of reverse logistics systems allows omni-channel companies to manage the reverse flow effectively by responding rapidly to customer requirements (Han & Cueto, 2016). The moderation analysis also revealed that information systems moderate the relationship between customers and flexibility toward omni-channel firm performance. In particular, Mahindroo et al. (2018) stated that the information system is critical to maintaining the connection with the customer through quick response time and managing the return efficiently.

As the reverse logistics system must adapt to the changing environment, this study tested the relationship between task environment factors and firm performance in an omni-channel context. The results demonstrate that customer is a significant factor in predicting omni-channel firm performance. Companies can sustain themselves in the omni-channel environment when the reverse logistics system recognizes customer requirements. Companies that offer good after-sales service will help to intensify customer loyalty and enhance the firm's competitive advantages (Abdullah & Yaakub, 2015). More interestingly, the supplier was found to have varying impacts on omni-channel firm performance. The outcomes reveal that degree of conformity with suppliers positively impacted omni-channel firm performance. The integration of suppliers in reverse logistics management will improve omni-channel firm performance. An omni-channel firm that integrates with suppliers would have an effective and efficient reverse logistics system.

Contrary to expectations before the study, competitors and regulators had no significant influence on omni-channel firm performance. The moderation analysis revealed that competitors are moderators to influence the relationship between customers and flexibility with omni-channel firm performance. Omni-channel companies that recognize the change of competitors would better conform to the customer requirement. These firms are paying attention to how other companies attract customers using reverse logistics systems (Ye et al., 2013).

The regulator's moderation analysis was also conducted in the reverse logistics system. However, the result revealed that the regulator did not act as a moderator to influence omni-channel firm performance. This result refutes previous studies showing a direct or indirect relationship between regulators and firm performance (Álvarez-Gil et al., 2007; Carter & Ellram, 1998; Y. C. Huang et al., 2015; Ye et al., 2013). Nevertheless, none of these studies were conducted in Malaysia, and the difference lies in the legislation of Malaysia with other countries. Other countries have enforced some legislation or policy to motivate companies to be responsible for returned products or materials, such as Taiwan (Ye et al., 2013) and Western Countries (Canning, 2006). In Malaysia, companies are less facing legislation regarding reverse logistics. So, Malaysia's omni-channel companies may not benefit from the regulator for implementing reverse logistics effectively (Eltayeb & Zailani, 2011). However, studies also indicated that the regulator is a factor that

influences the implementation of reverse logistics. In contrast, the relationship between the regulator and firm performance is mediated by the reverse logistics system, which needs further study (Y. C. Huang et al., 2015). Nevertheless, the main focus of this study was to develop a fundamental theory for reverse logistics in omni-channel, so the regulator's role will not be further explored in this study.

6. Conclusion

As mentioned before, the main objective of this study was to investigate the reverse logistics system in an omni-channel ecosystem. Unfortunately, current studies in the supply chain have not kept up with the latest trends in omni-channel, which cannot provide the knowledge to solve complex, multifaceted issues. This analysis offers an understanding of the reverse logistics mechanism underlying how these factors have the potential to improve firm performance for achieving sustainability. The reverse logistics system is constructed with internal and external elements influencing omni-channel firm performance. That is similar to other studies analyzing reverse logistics systems' roles in boosting company performance (Abdullah & Yaakub, 2015; Ye et al., 2013). This understanding provides a comprehensive view of the evolution of reverse logistics, specifically the transition into an omni-channel business environment.

Based on the findings, significant factors, including flexibility, collaboration, supplier, and customer, could influence the ability of the reverse logistics system to boost performance. At the same time, significant indirect factors, including top management support, information system, formalization, and competitor, play a role in facilitating the reverse logistics flow that could improve firm performance. These indirect drivers will become restrictions for omni-channel companies to continue success if these drivers are not present. The summarized result is illustrated in the Omni-channel Reverse Logistics Framework.

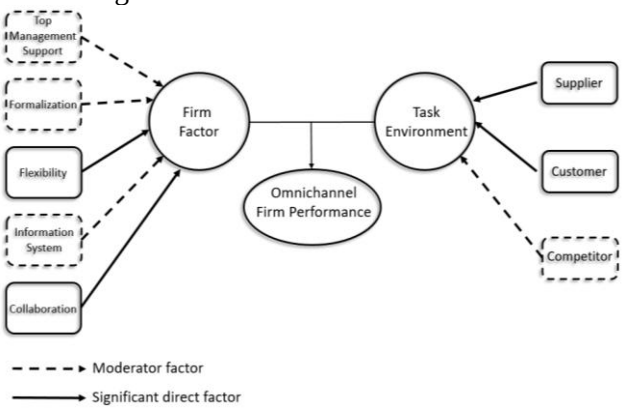

Figure 2. The omni-channel reverse logistics framework

This study could contribute to the prior unexplored context of reverse logistics in the current era (Dias et al., 2019). Reverse logistics has been recognized as a part of sustainability in supply chain management, and this study will advance in the field of reverse logistics or the issue of sustainability (Banihashemi et al., 2019; Carter & Easton, 2011). Furthermore, a robust framework comprised of all relevant theories and frameworks could be established to provide a multifaceted view of reverse logistics that improves the understanding of certain phenomena of reverse logistics in an organization. Hence, this research provides empirical evidence that both firm and task environment factors are significant in reverse logistics and support omni-channel companies to sustain themselves in the market. That is an important contribution to our knowledge because it is the first study to examine reverse logistics strategic aspects in an omni-channel context. From the aspect of practical contribution, managers and related practitioners may be able to manipulate reverse logistics systems to improve firm performance. From a practical perspective, omni-channel companies, including retailers, manufacturers, and logistics service providers, can design systematic reverse logistics programs to help their companies to perform better.

The study examined the convergent reverse logistics element from many previous theories. This research revealed the factors that have become increasingly important in today's reverse logistics system, such as customer and flexibility. However, other factors that could better explain the relationship between reverse logistics systems and omni-channel firm performance could be included in the framework. Future studies could investigate other factors within the firm and task environment context to boost firm performance. This framework could serve as a guideline for other researchers looking into the other predictors in the reverse logistics system.

Reverse logistics is one of the critical functions within the supply chain, which improves the relationship between stakeholders and entrepreneurs for both mutually. In conclusion, this study develops an omni-channel reverse logistics framework that could help companies implement an excellent reverse logistics system. Furthermore, this study proved that both firm and task environment factors in reverse logistics systems are effective in the omni-channel environment.

7. Limitations and Further Study

This research was conducted in Malaysia, with data collected from Malaysian entrepreneurs. Therefore, the generalization of the results was robust in the Malaysian context. The final goal of this study was to develop a robust theoretical framework for omni-channel companies in Malaysia. However, a good theoretical framework should be applied to generalize different populations. Hence, further studies could be replicated in other contexts to investigate the framework further. Furthermore, this research allows other researchers to explore the omni-channel reverse logistics system from various perspectives, including countries and cultures.

As a result, the theoretical framework can be further refined and extended.

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Authors' Contributions

Jing Foo Yee conducted the entire study under the guidance of Emy Ezura.

References

[1] ABDULLAH, N.A.H.N., & YAAKUB, S. (2015). The pressure for reverse logistics adoption among manufacturers in Malaysia. *Asian Journal of Business and Accounting*, 8(1), 151–178. Retrieved from https://ajba.um.edu.my/index.php/AJBA/article/view/2710/1517

[2] ÁLVAREZ-GIL, M.J., BERRONE, P., HUSILLOS, F.J., & LADO, N. (2007). Reverse logistics, stakeholders' influence, organizational slack, and managers' posture. *Journal of Business Research*, 60(5), 463–473. https://doi.org/10.1016/j.jbusres.2006.12.004

[3] ANDERSON, J.C., & GERBING, D.W. (1991). Predicting the Performance of Measures in a Confirmatory Factor Analysis With a Pretest Assessment of Their Substantive Validities. *Journal of Applied Psychology*, 76(5), 732–740. https://doi.org/10.1037/0021-9010.76.5.732

[4] AUTRY, C.W., DAUGHERTY, P.J., & GLENN RICHEY, R. (2001). The challenge of reverse logistics in catalog retailing. *International Journal of Physical Distribution and Logistics Management*, 31(1), 26–37. https://doi.org/10.1108/09600030110366384

[5] BAI, C., & SARKIS, J. (2013). Flexibility in reverse logistics: A framework and evaluation approach. *Journal of Cleaner Production*, 47, 306–318. https://doi.org/http://dx.doi.org/10.1016/j.jclepro.2013.01.005

[6] BANIHASHEMI, T.A., FEI, J., & CHEN, P.S.-L. (2019). Exploring the relationship between reverse logistics and sustainability performance. *Modern Supply Chain Research and Applications*, 1(1), 2–27. https://doi.org/10.1108/mscra-03-2019-0009

[7] BERNON, M., CULLEN, J., & GORST, J. (2016). Online retail returns management: Integration within an omni-channel distribution context. *International Journal of Physical Distribution and Logistics Management*, 46(6–7), 584–605. https://doi.org/10.1108/IJPDLM-01-2015-0010

[8] CAIN, M.K., ZHANG, Z., & YUAN, K.H. (2017). Univariate and multivariate skewness and kurtosis for measuring nonnormality: Prevalence, influence and estimation. *Behavior Research Methods*, 49(5), 1716–1735. https://doi.org/10.3758/s13428-016-0814-1

[9] CANNING, L. (2006). Rethinking market connections: Mobile phone recovery, reuse and recycling in the UK. *Journal of Business and Industrial Marketing*, 21(5), 320–329. https://doi.org/10.1108/08858620610681623

[10] CARTER, C.R., & EASTON, P.L. (2011). Sustainable supply chain management: Evolution and future directions. *International Journal of Physical Distribution and Logistics Management*, 41(1), 46–62. https://doi.org/10.1108/09600031111101420

[11] CARTER, C.R., & ELLRAM, L. (1998). Reverse Logistics - a Review of the Literature and Framework for Future Investigation. *Journal of Business Logistics*, 19(1), 85-102. Retrieved from https://www.library.northwestern.edu/find-borrow-request/requests-interlibrary-loan/lending-institutions.html

[12] CHU, S. H., YANG, H., LEE, M., & PARK, S. (2017). The impact of institutional pressures on green supply chain management and firm performance: Top management roles and social capital. *Sustainability*, 9(5), 764. https://doi.org/10.3390/su9050764

[13] DAHLSTROM, R., MCNEILLY, K. M., & SPEH, T. W. (1996). Buyer-seller relationships in the procurement of logistical services. *Journal of the Academy of Marketing Science*, 24(2), 110–124. https://doi.org/10.1177/0092070396242002

[14] DANESE, P. (2013). Supplier integration and company performance: A configurational view. *Omega*, 41(6), 1029–1041. https://doi.org/10.1016/j.omega.2013.01.006

[15] DAUGHERTY, P.J., RICHEY, R.G., GENCHEV, S.E., & CHEN, H. (2005). Reverse logistics: Superior performance through focused resource commitments to information technology. *Transportation Research Part E: Logistics and Transportation Review*, 41(2), 77–92. https://doi.org/10.1016/j.tre.2004.04.002

[16] DEPARTMENT OF STATISTICS MALAYSIA. (2017). *Economic Census 2016: Establishment Statistics*. Retrieved from https://www.dosm.gov.my/v1/index.php?r=column/cthree&menu_id=UEg1NkpJUFYzRzBKclE4V2JEb2I3QT09

[17] DIAS, K.T.S., BRAGA, S. S., SILVA, D., & SATOLO, E. G. (2019). Reverse Logistics for Returns management in Retail: A Systematic Literature Review from 2007 to 2016. In J. MULA, R. BARBASTEFANO, M. DÍAZ-MADROÑERO, & R. POLER (Eds.), *New Global Perspectives on Industrial Engineering and Management* (1st ed., pp. 145–153). Springer International Publishing. https://doi.org/10.1007/978-3-319-93488-4

[18] ELTAYEB, T. K., & ZAILANI, S. (2011). Drivers on the reverse logistics : evidence from Malaysian certified companies Tarig Khidir Eltayeb and Suhaiza Hanim Mohamad Zailani. *International Journal of Logistics Systems and Management*, 10(4), 375–397. http://dx.doi.org/10.1504/IJLSM.2011.043101

[19] FORNELL, C., & LARCKER, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research*, 18(1), 39–50. https://doi.org/10.2307/3151312

[20] GARCÍA-SÁNCHEZ, E., GUERRERO-VILLEGAS, J., & AGUILERA-CARACUEL, J. (2018). How do technological skills improve reverse logistics? The moderating role of top management support in information technology use and innovativeness. *Sustainability*, 11(1), 58. https://doi.org/10.3390/su11010058

[21] GENCHEV, S.E., RICHEY, R.G., & GABLER, C.B. (2011). Evaluating reverse logistics programs: A suggested process formalization. *International Journal of Logistics Management*, 22(2), 242–263. https://doi.org/10.1108/09574091111156569

[22] HAHN, E.D., & ANG, S.H. (2017). From the editors: New directions in the reporting of statistical results in the Journal of World Business. *Journal of World Business*, 52(2), 125–126. https://doi.org/10.1016/j.jwb.2016.12.003

[23] HAIR, J.F., HULT, G.T.M., RINGLE, C.M., & SARSTEDT, M. (2017). *A primer on partial least squares structural equation modeling (PLS-SEM)*. SAGE Publications. https://doi.org/10.1080/1743727x.2015.1005806

[24] HAIR, J.F., RISHER, J.J., SARSTEDT, M., & RINGLE, C.M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, 31(1), 2–24. https://doi.org/10.1108/EBR-11-2018-0203

[25] HALL, R.H., JOHNSON, N.J., & HAAS, J.E. (2016). Organizational Size, Complexity, and Formalization. *American Sociological Review*, 32(6), 903–912.

[26] HAN, H., & CUETO, E.P. (2016). Formalization of reverse logistics programs: A theoretical framework. *Brazilian Journal of Operations & Production Management*, 13(2), 160–172. https://doi.org/10.14488/bjopm.2016.v13.n2.a3

[27] HENSELER, J., & CHIN, W.W. (2010) A comparison of approaches for the analysis of interaction effects between latent variables using partial least squares path modeling. *Structural Equation Modeling*, 17(1), 82–109. https://doi.org/10.1080/10705510903439003

[28] HO, G.T.S., CHOY, K.L., LAM, C.H.Y., & WONG, D.W.C. (2012). Factors influencing implementation of reverse logistics: A survey among Hong Kong businesses. *Measuring Business Excellence*, 16(3), 29–46. https://doi.org/10.1108/13683041211257394

[29] HSU, C.C., TAN, K.C., ZAILANI, S.H.M., & JAYARAMAN, V. (2013). Supply chain drivers that foster the development of green initiatives in an emerging economy. *International Journal of Operations and Production Management*, 33(6), 656–688. https://doi.org/10.1108/IJOPM-10-2011-0401

[30] HUANG, Y.C., RAHMAN, S., WU, Y.C.J., & HUANG, C.J. (2015). Salient task environment, reverse logistics and performance. *International Journal of Physical Distribution and Logistics Management*, 45(9–10), 979–1006. https://doi.org/10.1108/IJPDLM-08-2014-0182

[31] HUANG, Y.C., & YANG, M.L. (2014). Reverse logistics innovation, institutional pressures and performance. *Management Research Review*, 37(7), 615–641. https://doi.org/10.1108/MRR-03-2013-0069

[32] HUANG, Y., YANG, M.L., & WONG, Y.J. (2016). Institutional pressures, resources commitment, and returns management. *Supply Chain Management*, 21(3), 398–416. https://doi.org/10.1108/SCM-04-2015-0144

[33] HÜBNER, A., HOLZAPFEL, A., & KUHN, H. (2016). Distribution systems in omni-channel retailing. *Business Research*, 9(2), 255–296. https://doi.org/10.1007/s40685-016-0034-7

[34] HUSCROFT, J.R. (2010). *The Reverse Logistics Process in the Supply Chain and Managing Its Implementation*. [PhD Thesis, Auburn University]. Retrieved from https://etd.auburn.edu/bitstream/handle/10415/2438/Huscroft_FINAL_Ver_3_Dissertation_TC_good.pdf?sequence=2

[35] JALIL, E.E.A. (2017). *Reverse logistics symbiosis in waste recycling: Investigating municipal systems and household behaviour in England*. [Doctoral thesis, The University of Hull]. Digital Repository. Retrieved from https://hydra.hull.ac.uk/resources/hull:16607

[36] JALIL, E.E.A., GRANT, D.B., NICHOLSON, J.D., & DEUTZ, P. (2016). Reverse logistics in household recycling and waste systems: a symbiosis perspective. *Supply Chain Management*, 21(2), 245–258. https://doi.org/10.1108/SCM-02-2015-0056

[37] JESZKA, A.M. (2014). Product Returns Management in the Clothing Industry in Poland. *Scientific Journal of Logistics*, 10(4), 433–443. Retrieved from https://www.logforum.net/pdf/10_4_7_14.pdf

[38] KAUR, K., OSMAN, S., ABU BAKAR, E., & SABRI, M. F. BIN. (2019). Future of Retailing in Malaysia : Omni-channel retailing. *International Research Conference on Multidisciplinary in Social Sciences and Technology (pp. 1-14)*. IRCMSST. Retrieved from

https://www.researchgate.net/publication/334557889_Future_of_Retailing_in_Malaysia_Omni-channel_retailing

[39] LAU, K.H., & WANG, Y. (2009). Reverse logistics in the electronic industry of China: A case study. *Supply Chain Management*, 14(6), 447–465. https://doi.org/10.1108/13598540910995228

[40] LEU, J.F.Y., & MASRI, R. (2021). Omni-Channel Retailing and Digital Business: A Case Study in Malaysia. *Journal of Asian Finance, Economics and Business*, 8(4), 403–412. https://doi.org/10.13106/jafeb.2021.vol8.no4.0403

[41] MAHINDROO, A., SAMALIA, H.V., & VERMA, P. (2018a). Information systems road map to enhance economic and operational reverse logistics performance. *International Journal of Logistics Systems and Management*, 29(2), 215–240. https://doi.org/10.1504/IJLSM.2018.089172

[42] MAHINDROO, A., SAMALIA, H.V., & VERMA, P. (2018b). Moderated influence of return frequency and resource commitment on information systems and reverse logistics strategic performance. *International Journal of Productivity and Performance Management*, 67(3), 550–570. https://doi.org/10.1108/IJPPM-05-2016-0101

[43] MAHUSNI, M.N.A., & ABDUL GHAFAR, M. (2018). Adaptation of Malaysian Retail Design Towards Omni–Channel and Contextual Retail Concept. *Malaysian Journal of Sustainable Environment*, 4(1), 95. https://doi.org/10.24191/myse.v4i1.5609

[44] MAI, E.S., CHEN, H., & ANSELMI, K. (2012). The role of returns management orientation, internal collaboration, and information support in reverse logistics. *Journal of Transportation Management*, 23(1), 45–59. https://doi.org/10.22237/jotm/1333238640

[45] MILLS, R. (2007). Sustainability, Regulation and Reverse Logistics. *Henley Manager Update*, 18(4), 21–28. https://doi.org/10.1177/174578660701800403

[46] MORGAN, T.R., RICHEY, R.G., & AUTRY, C.W. (2016). Developing a reverse logistics competency: The influence of collaboration and information technology. *International Journal of Physical Distribution and Logistics Management*, 46(3), 293–315. https://doi.org/10.1108/IJPDLM-05-2014-0124

[47] NAIR, A. (2005). Linking manufacturing postponement, centralized distribution and value chain flexibility with performance. *International Journal of Production Research*, 43(3), 447–463. https://doi.org/10.1080/00207540512331311886

[48] NEUMAN, W.L. (2002). Social Research Methods: Qualitative and Quantitative Approaches. *Teaching Sociology*, 30(3), 380-381. https://doi.org/10.2307/3211488

[49] NGESA, C.O., & SHALE, N.I. (2017). Role of Top Management Support in Supply Chain Performance in Distribution Sector in Kenya: Case of DHL Nairobi Kenya. *International Journal of Social Science and Humanities Research*, 5(2), 477–481. Retrieved from https://www.academia.edu/18855953/THE_ROLE_OF_TOP_LEVEL_MANAGEMENT_IN_SUPPLY_CHAIN_PERFORMANCE_A_CASE_STUDY_OF_MERU_TOWN_KENYA

[50] OLORUNNIWO, F.O., & LI, X. (2010). Information sharing and collaboration practices in reverse logistics. *Supply Chain Management*, 15(6), 454–462. https://doi.org/10.1108/13598541011080437

[51] RAI, H.B., MOMMENS, K., VERLINDE, S., & MACHARIS, C. (2019). How does consumers' omni-channel shopping behaviour translate into travel and transport impacts? Case-study of a footwear retailer in Belgium. *Sustainability*, 11(9), 2534. https://doi.org/10.3390/su11092534

[52] RAMAYAH, T., CHEAH, J., CHUAH, F., TING, H., & MEMON, M.A. (2018). *Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS 3.0: An Updated and Practical Guide to Statistical Analysis* (2nd ed.). Pearson Malaysia. Retrieved from https://www.goodreads.com/book/show/44057278-partial-least-squares-structural-equation-modeling-pls-sem-using-smart

[53] RICHEY, R.G., GENCHEV, S.E., & DAUGHERTY, P.J. (2005). The role of resource commitment and innovation in reverse logistics performance. *International Journal of Physical Distribution and Logistics Management*, 35(4), 233–257. https://doi.org/10.1108/09600030510599913

[54] SAGHIRI, S., WILDING, R., MENA, C., & BOURLAKIS, M. (2017). Toward a three-dimensional framework for omni-channel. *Journal of Business Research*, 77, 53–67. https://doi.org/10.1016/j.jbusres.2017.03.025

[55] SHAFIQ, S., & NAQVI, I.H. (2012). Top Management Support Partially Optimized Reverse Logistics in The Manufacturing Sector of Pakistan. *International Journal of Business and Social Research*, 2(3), 119–125. Retrieved from https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.679.5927&rep=rep1&type=pdf

[56] STANK, T.P., DAUGHERTY, P.J., & ELLINGER, A.E. (1999). Marketing Logistics Integration and Firm Performance. *The International Journal of Logistics Management*, 10(1), 11–24. https://doi.org/10.1108/09574099910805905

[57] STEVENSON, M., & SPRING, M. (2009). Supply chain flexibility: An inter-firm empirical study. *International Journal of Operations and Production Management*, 29(9), 946–971. https://doi.org/10.1108/01443570910986238

[58] TIBBEN-LEMBKE, R.S., & ROGERS, D.S. (2002). Differences between forward and reverse

logistics in a retail environment. *Supply Chain Management: An International Journal*, 7(5), 271–282. https://doi.org/10.1108/13598540210447719

[59] TIWARI, R.K. (2013). Reverse Logistics : Strategy to Achieve Total Customer Satisfaction and Enhancing Competitive Performance. *Inventi Rapid: Supply Chain & Logistics*, 2013(2), 1–9. Retrieved from https://www.researchgate.net/publication/311432596_REVERSE_LOGISTICS_STRATEGY_TO_ACHIEVE_TOTAL_CUSTOMER_SATISFACTION_AND_ENHANCING_COMPETITIVE_PERFORMANCE

[60] TOMBIDO, L.L., LOUW, L., & VAN EEDEN, J. (2018). A systematic review of 3pls' entry into reverse logistics. *South African Journal of Industrial Engineering*, 29(3), 235–260. https://doi.org/10.7166/29-3-2062

[61] UM, J. (2017). Improving supply chain flexibility and agility through variety management. *International Journal of Logistics Management*, 28(2), 464–487. https://doi.org/10.1108/IJLM-07-2015-0113

[62] VLACHOS, I.P. (2016). Reverse logistics capabilities and firm performance: the mediating role of business strategy. *International Journal of Logistics Research and Applications*, 19(5), 424–442. https://doi.org/10.1080/13675567.2015.1115471

[63] WU, G.C., DING, J.H., & CHEN, P.S. (2012). The effects of GSCM drivers and institutional pressures on GSCM practices in Taiwan's textile and apparel industry. *International Journal of Production Economics*, 135(2), 618–636. https://doi.org/10.1016/j.ijpe.2011.05.023

[64] YE, F., ZHAO, X., PRAHINSKI, C., & LI, Y. (2013). The impact of institutional pressures, top managers' posture and reverse logistics on performance - Evidence from China. *International Journal of Production Economics*, 143(1), 132–143. https://doi.org/10.1016/j.ijpe.2012.12.021

参考文:

[1] ABDULLAH, N.A.H.N., 和 YAAKUB, S. (2015). 马来西亚制造商采用了逆向物流的压力。亚洲商业与会计杂志， 8(1)， 151-178 。 从 ... 获得 https://ajba.um.edu.my/index.php/AJBA/article/view/2710/1517

[2] ÁLVAREZ-GIL, M.J., BERRONE, P., HUSILLOS, F.J., 和 LADO, N. (2007). 反向后勤、利益相关者的影响、组织松懈和管理者的姿态。商业研究杂志 , 60(5), 463–473. https://doi.org/10.1016/j.jbusres.2006.12.004

[3] ANDERSON, J.C., 和 GERBING, D.W. (1991). 通过对其实质性有效性的预测试评估来预测验证性因素分析中措施的绩效。应用心理学杂志, 76(5), 732–740. https://doi.org/10.1037/0021-9010.76.5.732

[4] AUTRY, C.W., DAUGHERTY, P.J., 和 GLENN RICHEY, R. (2001). 目录零售中逆向物流的挑战。国际物流与物流管理杂志, 31(1), 26–37. https://doi.org/10.1108/09600030110366384

[5] BAI, C., 和 SARKIS, J. (2013). 逆向物流的灵活性：一种框架和评估方法。清洁生产杂志, 47, 306–318. https://doi.org/http://dx.doi.org/10.1016/j.jclepro.2013.01.005

[6] BANIHASHEMI, T.A., FEI, J., 和 CHEN, P.S.-L. (2019). 探索逆向物流与可持续发展绩效之间的关系。现代供应链研究与应用, 1(1), 2–27. https://doi.org/10.1108/mscra-03-2019-0009

[7] BERNON, M., CULLEN, J., 和 GORST, J. (2016). 在线零售退货管理：全渠道分销环境中的集成。国际物流与物流管理杂志, 46(6–7), 584–605. https://doi.org/10.1108/IJPDLM-01-2015-0010

[8] CAIN, M.K., ZHANG, Z., 和 YUAN, K.H. (2017). 用于测量非正态性的单变量和多变量偏度和峰度：流行、影响和估计。行为研究方法, 49(5), 1716–1735. https://doi.org/10.3758/s13428-016-0814-1

[9] CANNING, L. (2006). 重新思考市场联系：英国的手机回收、再利用和再循环。商业与工业营销杂志 , 21(5), 320–329. https://doi.org/10.1108/08858620610681623

[10] CARTER, C.R., 和 EASTON, P.L. (2011). 可持续供应链管理：演变和未来方向。国际物流与物流管理杂志 , 41(1), 46–62. https://doi.org/10.1108/09600031111101420

[11] CARTER, C.R., 和 ELLRAM, L. (1998). 逆向物流 - 对未来调查的文献和框架的回顾。商业物流杂志， 19 （ 1 ） ， 85-102 。 从 ... 获得 https://www.library.northwestern.edu/find-borrow-request/requests-interlibrary-loan/lending-institutions.html

[12] CHU, S. H., YANG, H., LEE, M., 和 PARK, S. (2017). 制度压力对绿色供应链管理和企业绩效的影响：高层管理角色和社会资本。可持续性, 9(5), 764. https://doi.org/10.3390/su9050764

[13] DAHLSTROM, R., MCNEILLY, K. M., 和 SPEH, T. W. (1996). 物流服务采购中的买卖双方关系。营销科学院学报 , 24(2), 110–124. https://doi.org/10.1177/0092070396242002

[14] DANESE, P. (2013). 供应商整合和公司绩效：配置视图。欧米茄 , 41(6), 1029–1041. https://doi.org/10.1016/j.omega.2013.01.006

[15] DAUGHERTY, P.J., RICHEY, R.G., GENCHEV, S.E., 和 CHEN, H. (2005). 逆向物流：通过对信息技术的集中资源投入实现卓越绩效。运输研究E部分：物流和运输评论 , 41(2), 77–92.

https://doi.org/10.1016/j.tre.2004.04.002
[16] 马来西亚统计局. (2017). 2016年经济普查：机构统计。从 ... 获得 https://www.dosm.gov.my/v1/index.php?r=column/cthree&menu_id=UEg1NkpJUFYzRzBKclE4V2JEb2I3QT09
[17] DIAS, K.T.S., BRAGA, S. S., SILVA, D., 和 SATOLO, E. G. (2019). 零售退货管理的逆向物流：2007年至2016年的系统文献回顾。J. MULA, R. BARBASTEFANO, M. DÍAZ-MADROÑERO, & R. POLER（编辑），《工业工程与管理新全球视角》（第 1 版，第 145-153 页）。施普林格国际出版社. https://doi.org/10.1007/978-3-319-93488-4
[18] ELTAYEB, T. K., 和 ZAILANI, S. (2011). 逆向物流的驱动力：来自马来西亚认证公司塔里格 • 希迪尔 • 埃尔塔耶布 和 苏海扎 • 哈尼姆 • 穆罕默德扎拉尼 的证据。国际物流系统与管理杂志, 10(4), 375–397. http://dx.doi.org/10.1504/IJLSM.2011.043101
[19] FORNELL, C., 和 LARCKER, D. F. (1981). 评估具有不可观察变量和测量误差的结构方程模型。营销研究杂志，18(1), 39–50. https://doi.org/10.2307/3151312
[20] GARCÍA-SÁNCHEZ, E., GUERRERO-VILLEGAS, J., 和 AGUILERA-CARACUEL, J. (2018). 技术技能如何改善逆向物流？ 高层管理支持在信息技术使用和创新中的调节作用。可持续性, 11(1), 58. https://doi.org/10.3390/su11010058
[21] GENCHEV, S.E., RICHEY, R.G., 和 GABLER, C.B. (2011). 评估逆向物流计划：建议的流程形式化。国际物流管理杂志，22(2), 242–263. https://doi.org/10.1108/09574091111156569
[22] HAHN, E.D., 和 ANG, S.H. (2017). 来自编辑：《世界商业杂志》统计结果报告的新方向。世界商业杂志，52(2), 125–126. https://doi.org/10.1016/j.jwb.2016.12.003
[23] HAIR, J.F., HULT, G.T.M., RINGLE, C.M., 和 SARSTEDT, M. (2017). 偏最小二乘结构方程建模入门。圣人出版物. https://doi.org/10.1080/1743727x.2015.1005806
[24] HAIR, J.F., RISHER, J.J., SARSTEDT, M., 和 RINGLE, C.M. (2019). 何时使用以及如何报告最小二乘结构方程建模的结果。欧洲商业评论, 31(1), 2–24. https://doi.org/10.1108/EBR-11-2018-0203
[25] HALL, R.H., JOHNSON, N.J., 和 HAAS, J.E. (2016). 组织规模、复杂性和形式化。美国社会学评论, 32(6), 903–912.
[26] HAN, H., 和 CUETO, E.P. (2016). 逆向物流计划的形式化：一个理论框架。巴西运营与生产管理杂志，13(2), 160–172. https://doi.org/10.14488/bjopm.2016.v13.n2.a3
[27] HENSELER, J., 和 CHIN, W.W. (2010) 使用偏最小二乘路径建模分析潜在变量之间的交互作用的方法的比较。结构方程建模，17(1), 82–109. https://doi.org/10.1080/10705510903439003
[28] HO, G.T.S., CHOY, K.L., LAM, C.H.Y., 和 WONG, D.W.C. (2012). 影响逆向物流实施的因素：香港企业调查。衡量业务卓越, 16(3), 29–46. https://doi.org/10.1108/13683041211257394
[29] HSU, C.C., TAN, K.C., ZAILANI, S.H.M., 和 JAYARAMAN, V. (2013). 在新兴经济体中促进绿色倡议发展的供应链驱动因素。国际运营与生产管理杂志，33(6), 656–688. https://doi.org/10.1108/IJOPM-10-2011-0401
[30] HUANG, Y.C., RAHMAN, S., WU, Y.C.J., 和 HUANG, C.J. (2015). 突出的任务环境、逆向物流和绩效。国际物流与物流管理杂志, 45(9–10), 979–1006. https://doi.org/10.1108/IJPDLM-08-2014-0182
[31] HUANG, Y.C., 和 YANG, M.L. (2014). 逆向物流创新、制度压力和绩效。管理研究评论, 37(7), 615–641. https://doi.org/10.1108/MRR-03-2013-0069
[32] HUANG, Y., YANG, M.L., 和 WONG, Y.J. (2016). 制度压力、资源承诺和退货管理。供应链管理, 21(3), 398–416. https://doi.org/10.1108/SCM-04-2015-0144
[33] HÜBNER, A., HOLZAPFEL, A., 和 KUHN, H. (2016). 全渠道零售中的分销系统。商业研究, 9(2), 255–296. https://doi.org/10.1007/s40685-016-0034-7
[34] HUSCROFT, J.R. (2010). 供应链中的逆向物流过程及其实施管理。[博士论文，奥本大学]。从 ... 获得 https://etd.auburn.edu/bitstream/handle/10415/2438/Huscroft_FINAL_Ver_3_Dissertation_TC_good.pdf?sequence=2
[35] JALIL, E.E.A. (2017). 废物回收中的逆向物流共生：调查英格兰的市政系统和家庭行为。[博士论文，赫尔大学]。数字存储库。从 ... 获得 https://hydra.hull.ac.uk/resources/hull:16607
[36] JALIL, E.E.A., GRANT, D.B., NICHOLSON, J.D., 和 DEUTZ, P. (2016). 家庭回收和废物系统中的逆向物流：共生视角。供应链管理, 21(2), 245–258. https://doi.org/10.1108/SCM-02-2015-0056
[37] JESZKA, A.M. (2014). 波兰服装行业的产品退货管理。物流科学杂志，10（4），433-443。从 ... 获得 https://www.logforum.net/pdf/10_4_7_14.pdf
[38] KAUR, K., OSMAN, S., ABU BAKAR, E., 和 SABRI, M. F. BIN. (2019). 马来西亚零售业的未来：全渠道零售。社会科学与技术多学科国际研究会议（第 1-14 页）。社会科学与技术多学科国际研究会议。从 ... 获得 https://www.researchgate.net/publication/334557889

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[39] LAU, K.H., 和 WANG, Y. (2009). 中国电子行业的逆向物流：案例研究。供应链管理, 14(6), 447–465. https://doi.org/10.1108/13598540910995228

[40] LEU, J.F.Y., 和 MASRI, R. (2021). 全渠道零售和数字业务：马来西亚案例研究。亚洲金融、经济和商业杂志, 8(4), 403–412. https://doi.org/10.13106/jafeb.2021.vol8.no4.0403

[41] MAHINDROO, A., SAMALIA, H.V., 和 VERMA, P. (2018a). 提高经济和运营逆向物流绩效的信息系统路线图。国际物流系统与管理杂志, 29(2), 215–240. https://doi.org/10.1504/IJLSM.2018.089172

[42] MAHINDROO, A., SAMALIA, H.V., 和 VERMA, P. (2018b). 退货频率和资源承诺对信息系统和逆向物流战略绩效的适度影响。国际生产力与绩效管理杂志, 67(3), 550–570. https://doi.org/10.1108/IJPPM-05-2016-0101

[43] MAHUSNI, M.N.A., 和 ABDUL GHAFAR, M. (2018). 马来西亚零售对全方位渠道和情境零售概念的适应。马来西亚可持续环境杂志, 4(1), 95. https://doi.org/10.24191/myse.v4i1.5609

[44] MAI, E.S., CHEN, H., 和 ANSELMI, K. (2012). 退货管理导向、内部协作和信息支持在逆向物流中的作用。运输管理杂志, 23(1), 45–59. https://doi.org/10.22237/jotm/1333238640

[45] MILLS, R. (2007). 可持续性、监管和逆向物流。亨利经理更新, 18(4), 21–28. https://doi.org/10.1177/174578660701800403

[46] MORGAN, T.R., RICHEY, R.G., 和 AUTRY, C.W. (2016). 发展逆向物流能力：协作和信息技术的影响。国际物流与物流管理杂志, 46(3), 293–315. https://doi.org/10.1108/IJPDLM-05-2014-0124

[47] NAIR, A. (2005). 将制造延期、集中配送和价值链灵活性与绩效联系起来。国际生产研究杂志, 43(3), 447–463. https://doi.org/10.1080/00207540512331311886

[48] NEUMAN, W.L. (2002). 社会研究方法：定性和定量方法。教学社会学, 30(3), 380-381. https://doi.org/10.2307/3211488

[49] NGESA, C.O., 和 SHALE, N.I. (2017). 高层管理支持在肯尼亚分销部门供应链绩效中的作用：肯尼亚内罗毕的达尔西希尔布洛姆林恩案例。国际社会科学与人文研究杂志, 5(2), 477–481. 从...获得 https://www.academia.edu/18855953/THE_ROLE_OF_TOP_LEVEL_MANAGEMENT_IN_SUPPLY_CHAIN_PERFORMANCE_A_CASE_STUDY_OF_MERU_TOWN_KENYA

[50] OLORUNNIWO, F.O., 和 LI, X. (2010). 用逆向物流中的信息共享和协作实践。供应链管理, 15(6), 454–462. https://doi.org/10.1108/13598541011080437

[51] RAI, H.B., MOMMENS, K., VERLINDE, S., 和 MACHARIS, C. (2019). 消费者的全渠道购物行为如何转化为旅行和交通影响？比利时一家鞋类零售商的案例研究。可持续性, 11(9), 2534. https://doi.org/10.3390/su11092534

[52] RAMAYAH, T., CHEAH, J., CHUAH, F., TING, H., 和 MEMON, M.A. (2018). 使用智能偏最小二乘3.0进行偏最小二乘结构方程建模：统计分析的更新实用指南（第 2 版）。马来西亚培生。从...获得 https://www.goodreads.com/book/show/44057278-partial-least-squares-structural-equation-modeling-pls-sem-using-smart

[53] RICHEY, R.G., GENCHEV, S.E., 和 DAUGHERTY, P.J. (2005). 资源承诺和创新在逆向物流绩效中的作用。国际物流与物流管理杂志, 35(4), 233–257. https://doi.org/10.1108/09600030510599913

[54] SAGHIRI, S., WILDING, R., MENA, C., 和 BOURLAKIS, M. (2017). 迈向全渠道的三维框架。商业研究杂志, 77, 53–67. https://doi.org/10.1016/j.jbusres.2017.03.025

[55] SHAFIQ, S., 和 NAQVI, I.H. (2012). 最高管理层支持巴基斯坦制造业的部分优化逆向物流。国际商业与社会研究杂志，2(3)，119-125。从...获得 https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.679.5927&rep=rep1&type=pdf

[56] STANK, T.P., DAUGHERTY, P.J., 和 ELLINGER, A.E. (1999). 营销物流整合与企业绩效。国际物流管理杂志, 10(1), 11–24. https://doi.org/10.1108/09574099910805905

[57] STEVENSON, M., 和 SPRING, M. (2009). 供应链灵活性：企业间实证研究。国际运营与生产管理杂志, 29(9), 946–971. https://doi.org/10.1108/01443570910986238

[58] TIBBEN-LEMBKE, R.S., 和 ROGERS, D.S. (2002). 零售环境中正向物流和逆向物流之间的差异。供应链管理：国际期刊, 7(5), 271–282. https://doi.org/10.1108/13598540210447719

[59] TIWARI, R.K. (2013). 逆向物流：实现全面客户满意度和提高竞争绩效的战略。你发明得很快：供应链与物流，2013(2)，1-9。从...获得 https://www.researchgate.net/publication/311432596_REVERSE_LOGISTICS_STRATEGY_TO_ACHIEVE_TOTAL_CUSTOMER_SATISFACTION_AND_ENHANCING_COMPETITIVE_PERFORMANCE

[60] TOMBIDO, L.L., LOUW, L., 和 VAN EEDEN, J. (2018). 对 3 部分最小二乘法进入逆向物流的系统评价。南非工业工程杂志, 29(3), 235–260. https://doi.org/10.7166/29-3-2062

[61] UM, J. (2017). 通过品种管理提高供应链的灵活

性和敏捷性。国际物流管理杂志, 28(2), 464–487. https://doi.org/10.1108/IJLM-07-2015-0113

[62] VLACHOS, I.P. (2016). 逆向物流能力与企业绩效：企业战略的中介作用。国际物流研究与应用杂志, 19(5), 424–442. https://doi.org/10.1080/13675567.2015.1115471

[63] WU, G.C., DING, J.H., 和 CHEN, P.S. (2012). 绿色供应链管理的驱动力和制度压力对台湾纺织服装行业绿色供应链管理实践的影响。国际生产经济学杂志, 135(2), 618–636. https://doi.org/10.1016/j.ijpe.2011.05.023

[64] YE, F., ZHAO, X., PRAHINSKI, C., 和 LI, Y. (2013). 制度压力、高层管理人员姿态和逆向物流对绩效的影响——来自中国的证据。国际生产经济学杂志, 143(1), 132–143. https://doi.org/10.1016/j.ijpe.2012.12.021