MANAGEMENT & ACCOUNTING REVIEW

C O N T E N T S

Sustaining Businesses in a Global Turbulent Environment: The Role of Information Sharing

Sidah Idris[a] and Suhana Mohezar[b]
[a]Universiti Malaysia Sabah, Malaysia
[b]Universiti Malaya, Malaysia

ABSTRACT

Technological advancement and logistics commitment are key to the success of the connections between global companies and along the supply chain parties. While they provide critical services, each level of the network will present challenges and difficulty to all parties. This study aims to investigate the impact of technological capability and commitment to logistics integration on information sharing as well as global supply chain competitiveness. Data was collected from 177 local manufacturing firms competing in global markets. The findings indicate that commitment to logistics integration is significantly related with information sharing and global supply chain competitiveness. This study however, fails to establish a relationship between technological capability and global supply chain competitiveness. The findings also highlight information sharing as a mediator.

Keywords*: global supply chains; information sharing; logistics integration commitment*

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INTRODUCTION

Manufacturers from large and emerging economies have continuously played prominent roles as exporters to international markets (Ngo, Janssen, Leonidou, & Christodoulides 2016). The recent death of Trans Pacific Partnership has further indicated changes in the manufacturing world, in which Asian manufacturers will park their facilities in the U.S. to cater for the demand of both foreign and home countries (Sheth, 2017). Whilst engaging in the international market would potentially encourage global presence, the practice often creates challenges due to the various issues including distinct consumers' expectations, different tariffs and social cultural factors (Gereffi & Lee, 2012). This phenomenon marks the need for a fundamental change in the way manufacturers from emerging economies should manage their operations, so that they could continue competing at the highest level.

Within the operations management literature, many prior studies argue that the key to improving a firm's supply chain competitiveness depends on their internal characteristics, which are explained primarily by the rare, valuable and inimitable resources (e.g. Khalid Almarri & Paul Gardiner, 2014). Based on this conception, most of them illustrate that technological capability, which captures the availability of relevant internal IT infrastructures are important in successful global supply chain operations. Despite the importance of these studies, some scholars (e.g. Teece, 2014) contest that the internal resources alone may have failed the firms to compete in a turbulent and volatile environment, especially in global supply chains. With the global economy becoming more open, the sources of innovation and production are more diverse geographically and organisationally, requiring them to expand their focus on the whole process of value chains. Based on this argument, it is hence believed that a firm's global supply chain competitiveness may not only depend on its internal IT infrastructure, but also depends on the supply chain partners' willingness to integrate their existing systems, change their organisational processes and structures as well as share of accurate information. Whilst the concept of information sharing in the global supply chain environment is not new in developed economies, yet implementing such strategy remains scant in many manufacturing firms originating from developing countries. Some studies indicate that the practice has been low in some cases, firms have even

abandoned it (Mohezar & Nor, 2014). Despite the significance of developing economies' participation in global supply chains, they are commonly at a disadvantage as compared with multinational manufacturers from developed countries, since they tend to depend more on low cost strategy and move away from heavy investment on information sharing technologies. With much manufacturing outsourced from developing economies, it is imperative to address this issue from the perspective of emerging economic nation. In addition to technological capability, there is a strand of research that focusses on the impact of logistics integration on supply chain competitiveness. Whilst some studies suggest successful integration of logistics might lead to positive outcome (e.g. Prajogo, Oke, & Olhager, 2016), other empirical studies document the opposite direction (Schoenherr & Swink, 2012). The conflicting results suggest the existence of a mediator.

The motivation of this study is therefore, to empirically examine how information sharing mediates the relationship between technological capability, commitment to logistics integration and supply chain competitiveness. This study contributes to the emerging interests in this field by focusing on developing economies, specifically the Malaysian manufacturing industry. Differing from prior research which investigates multinational corporations' such as Motorola and Nike (Doorey, 2011), this study concentrates on the local home-grown manufacturing firms that compete in the global market. Furthermore, most of the earlier studies on global supply chain competitiveness were conducted in developed countries (Lock Romis, 2012; Golgeci & Arslan, 2014). Despite these studies providing insights, firms within the emerging nation may have distinctive characteristics and behavioural patterns, which may result in different findings. This study wishes to determine the extent to which these scales and relationships could be replicated for emerging countries.

LITERATURE REVIEW

Supply Chain Competitiveness

Since the 1970 and 1980s, the U.S manufacturing firms have been slicing up their supply chains in search of low-cost and capable suppliers offshore (Dicken, 2011). Notwithstanding 52 percent of Asia's manufacture

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exports were also destined for developing countries (WTO, 2011), indicating a shift of the end markets in the global economy. While globalization creates opportunities for increased manufacturing product exports, the integration of Malaysia into international markets not only entails the local firms to comply with stricter quality regulations and produce technology-intensive goods, they also need to be able to achieve sustainable manufacturing practices by incorporating social and environmental dimensions, which may impede their participation (Zubir et al., 2012). The local manufacturing firms need to be able to develop effective management practices to help them in competing globally and to be more secure in times of economic crisis. The increased uncertainty on the global growth outlook, particularly in the industries that are more dependent on the advanced economies, such as the Electronic and Electric (E&E) sector may lead to challenges in the competitiveness of Malaysian export sector (Idris & Mohezar, 2017).

In addition, many industries and markets have truly become global. Thus, companies have and will continue to increase their degree of international sourcing and product distribution. The business environment in which most companies operate has changed significantly (Idris & Mohezar, 2017). Decisions affecting international operations and profitability must be made with accurate, timely, and comprehensive cost of information. Supply chain partners could share forecasts, trends and plans to sustain and enhance company and supply chain competitiveness (Yigitbasioglu, 2010).

Logistics Integration Commitment

The complexity of booking, cross-border tracking and other transactions involving global logistics processes increases the need to build necessary telecommunication and information systems (Steffanson, 2006). Yet, some technological systems such as EDI which have been developed independently in the various trading block have led to compatibility problems in the global logistics process.

Technological Capabilities

There is growing argument that rapid development of information and communication technology (ICT) has expedited effective SCM. Technology offers support in managing SC globally by facilitating the flow of materials

and transactions with a more efficient way of communicating and sharing information (Idris & Mohezar, 2017).

Despite the numerous studies on information technology and supply chain performance in the past, most of them conceptualized he information technology capabilities construct as technology alignment, inter-organizational technology integration and e-integration (Rajaguru & Matanda, 2013; Wu, Yeniyurt, Kim & Cavusgil, 2006; Morgan, Richey & Autry, 2016), which are mainly based on the technical aspects. Rajaguru and Matanda (2013) for instance, have conducted a study involving Australian retail operators (Idris & Mohezar, 2017).

Information sharing as a mediating factor

Information sharing is an activity while visibility is a potential outcome of information sharing. This will lead to a more effective supply chain (Barratt & Oke, 2007) and increased ability to jointly meet end-user's needs. As information sharing is closely related to the success of the supply chain (Thun, 2010; Kogoclu et al., 2012), it is imperative to further identify the fundamentals that contribute to such practice, how it could help the local firms in gaining global supply chain competitiveness. With much manufacturing outsourced from emerging economies, addressing this issue from the perspective of emerging economies is in need.

CONCEPTUAL MODEL AND HYPOTHESES DEVELOPMENT

Technological capability is seen as particularly important in global supply chains, since firms around the world are increasingly sourcing materials and marketing their products in international markets (Greene, Brush & Brown, 2015). Technologies such as e-marketplace for example, may facilitate firms in entering into new markets which are inaccessible owing to the geographical restrictions. Based on this argument, this study postulates that:

H1: *Technological capability is positively related to global supply chain competitiveness.*

Organisations entering alliances may find that maintaining and achieving information exchange is difficult if partners do not possess technological capabilities (Rajaguru & Matanda, 2013). Expanding connectivity to multiple partners involves multiple transactions beyond shipping orders or invoices requiring a variety of software and networking protocols. Based on these arguments, this study postulates that:

H2: *Technological capability is positively related to information sharing.*

Commitment to logistics integration refers to the long-term orientation between suppliers and buyers in maintaining the coordination of the logistics function. In a global environment, integration of logistics is important since international operations are associated with a larger geographical distance, higher degree of uncertainties, risks of long-lead time and inaccurate demand forecasting (Sajadieh, 2009). Integration of logistics would allow a firm's capability to ensure a seamless connection between supply chain partners, which will result in a reduced bullwhip effect (Prajogo et al., 2016). Based on this argument, this study postulates that:

H3: *Logistics integration commitment is positively related to global supply chain competitiveness.*

*D*espite the importance of logistics integration commitment, the cost and difficulties in coordinating the logistics function might be overwhelming, encouraging firms to invest in information sharing practices as an effort to facilitate them in coordinating the global supply chain network (Mingxiu, Chunchang & Minggen, 2012). Considering this, firms that are committed to enhancing their logistics function would view information exchange practices as strategically important to their business. Following these arguments, this study postulates that:

H4: *Commitment to logistics integration is positively related to information sharing.*

Whilst the technological capabilities are pertinent in achieving competitiveness, the frequency, quantity and quality of information that is shared play a pertinent role (Fawcett et al. 2007). Large investments in technology could fail to produce benefits if it is not supported by willingness to share information. Based on these arguments, this study postulates that:

H5: *Information sharing is positively related to global supply chain competitiveness.*

The expected benefits of technological advances and commitment to logistics integration could be retarded without the willingness of firms to exchange strategic information as well as transactional data such as materials or product order (Fawcett et al. 2007). Similarly, few researchers have related logistics integration and technological capability to information sharing, which in turn, creates value in the exchange relationships (Prajago et al. 2016), pointing to the possibility that information sharing may mediate the relationship between global supply chain capability factors and global supply chain competitiveness.

H6: *Information sharing mediates the relationship between global supply chain capability factors (technology capability, logistics integration commitment) and firms' global supply chain competitiveness.*

Following the extant literature, a research framework (Figure 1) was developed.
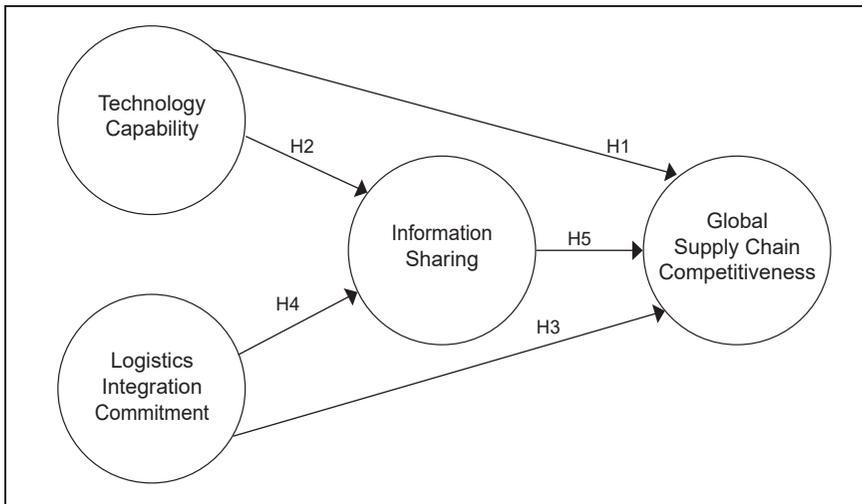
Figure 1: Conceptual Framework

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METHOD

The measures used in this study were adapted from previous literature. Technological capability was measured using 4 items adapted from Wu et al. (2006), while commitment to logistics integration was assessed using 4 items adapted from Zhoa et al. (2008). Based on Li et al. (2009), 7 items were adapted to assess information sharing. Global supply chain competitiveness was measured using 9 items from Golgeci and Arslan (2014). Respondents were asked to rate their perceptions on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). This study employed a survey method using questionnaires to test the conceptual model and the hypotheses. The sampling frame for this study was drawn from the list of food manufacturers registered with the Malaysian External Trade Division Corporation (MATRADE) as of January 2016. A questionnaire, including a cover letter, self-addressed and stamped envelopes was mailed to the CEO, managers or owners whose roles are crucial in supply chain operations. Of 1200 questionnaires mailed out, 177 questionnaires were returned, which resulted in a 14.8 per cent response rate. Table 1 presents the sample characteristics. The results reflect that most of the samples are characterised as small and medium enterprises. Most of them are mainly from the electronic and electrical industry.

Table 1: Respondent Profiles

Profile	Frequency	Percentage
Sector		
Electrical and electronics	68	38.4
Food and beverage	35	19.8
Furniture and wood based	12	6.8
Paper and stationary	10	5.6
Rubber based	10	5.6
Plastics	10	5.6
Clothing and Footwear	15	8.5
Cosmetics and toiletries	7	4.0
Automotive, metals and equipment	5	2.8
Chemicals	5	2.8
By Number of Employees		
1 to 50	54	30.5
51 to 100	47	26.6
101 to 1000	47	26.6
1001 and above	29	16.4

RESULTS AND DISCUSSION

A measurement model, comprising all the constructs of interest was evaluated based on convergent and discriminant validity tests (Hair, Hult, Ringle & Sarstedt, 2013). Convergent validity was examined based on factor loadings, composite reliability and average variance extracted (AVE). As indicated in Table 2, all the variables had a composite reliability and AVE greater that the cut-off point of 0.7 and 0.5 respectively (Hair et al. 2013). In this study, all the scales appear to have a substantially higher AVE value compared to their correlation with other constructs, providing evidence of discriminant validity (Fornell & Larcker,1981). The results of the measurement model indicate that various validity and reliability criteria are satisfied.

Table 2: Convergent Validity

	Constructs	Loading	t-value
Technology capability (AVE = 0.73; CR= 0.83)			
TC1	My organisation uses the most advanced IT systems	0.868***	11.97
TC2	My organisation has skilled and knowledgeable IT staff	0.828***	6.86
TC3	My organisation is experienced in deploying IT applications	0.775***	5.96
TC4	Our supply chain partners' information systems are technically compatible with those of our firm.	0.912***	13.15
TC5	There are direct computer-to-computer links with my key supply chain partners	0.871***	12.90
Logistics integration commitment (AVE= 0.86; CR=0.85)			
LC1	Logistics integration has a key role in our supply chain from the providing raw material to the end delivery.	0.926***	58.50
LC2	We have seamless integration of logistics activities with our key supply chain partners	0.942***	94.40
LC3	The inbound and outbound distribution of goods with our supply chain partners is well integrated	0.887***	44.76
LC4	Inter-organisational logistics activities are closely coordinated	0.936***	41.09

	Global supply chain competitiveness (AVE = 0.87; CR=0.77)		
GS1	Compared to our competitors, our supply chain can provide low cost distribution.	0.761***	24.06
GS2	Compared to our competitors, our supply chain can provide effective intensive local distribution coverage.	0.865***	36.55
GS3	Compared to our competitors, our supply chain is capable of effectively targeting selective distribution outlets.	0.893***	43.30
GS4	Compared to our competitors, our supply chain can assess information networks for both the global and local marketplace.	0.947***	97.65
GS5	Compared to our competitors, our supply chain can provide good workers and planning responsibility	0.930***	86.56
GS6	Compared to our competitors, our supply chain can use advanced technology.	0.905***	51.98
GS7	Compared to our competitors, our supply chain can use the JIT strategy.	0.838***	31.52
GS8	Compared to our competitors, our supply chain is capable of increasing production capacity.	0.848***	34.86
GS9	Compared to our competitors, our supply chain is capable of sharing information	0.878***	41.98
	Information sharing (AVE= 0.85; CR=0.72)		
IS1	Our organization exchanges and shares information related to changes in end-users needs, preference, and behaviour.	0.913***	66.46
IS2	Our organization exchanges and shares information related to changes in the technology of the focal products.	0.894***	54.97
IS3	Our organization exchanges and shares information within the network as soon as an unexpected problem arises.	0.799***	22.93
IS4	Our organization exchanges and shares information in the organizations' strategies and policies with network partners.	0.899***	60.48
IS5	Our organization exchanges and shares information of financial performance and organization know-how within network partners	0.872***	41.08
IS6	Our organization has established an information network to distribute sales information.	0.794***	23.98
IS7	Our organization shares information with suppliers and buyers via the Extranet.	0.757***	18.53

*Note ***p is significant at 0.001 level*

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Table 3: Discriminant Validity

Construct	1	2	3	4
1. Logistics integration commitment	0.92			
2. Technology capability	0.588	0.85		
3. Information sharing	0.534	0.591	**0.85**	
4. Global supply chain competitiveness	0.632	0.653	0.356	**0.87**

Note: The numbers in bold in the diagonal row are square roots of the AVE

If the measurement model satisfied the psychometric assessment, a structural model was constructed. Nonparametric bootstrapping was applied (Wetzels, Odekerken-Schroder, & van Oppen, 2009) with 2000 replications to test the structural model. The results suggest that the model can explain 47.5% of the variance in global supply chain competitiveness and 27.2% of the variance in information sharing. This study finds that technological capability is significantly related to information sharing (β = 0.49, p < 0.01). The effect of technological capability on global supply chain competitiveness however is not significant. The results also highlight that commitment to logistics integration is positively related with information sharing (β = 0.20, p < 0.01) and global supply chain competitiveness (β = 0.49, p < 0.01). The findings also indicate that information sharing is positively related to global supply chain competitiveness (β = 0.49, p < 0.01). As such, H2, H3, H4 and H5 are supported, while H1 is rejected (Table 4).

Table 4: Estimated Path Coefficient – Direct Effect

Path	β	t-value	Hypotheses	Results
GSß----TC	0.01	0.91	H1	Not supported
ISß----TC	0.42	3.99***	H2	Supported
GS<----LC	0.54	3.95***	H3	Supported
IS<----LC	0.32	3.43***	H4	Supported
GS<-----IS	0.58	7.50***	H5	Supported

Note: GS = Global Supply Chain Competitiveness; TC = Technology Capability; LC= Logistics Commitment Integration IS= Information Sharing

In addition to the direct effect, this study also tested the mediation effect of information sharing on the relationship between antecedent

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factors (technological capability and commitment to logistics integration) and global supply chain competitiveness by using the Baron and Kenny's (1986) method. The result for the mediation tests indicates that in the first step, in the sub-model tests, all five independent variables had an influence on global supply chain competitiveness. In sub model 1, technological capability and commitment to logistics integration had a positive effect on global supply chain competitiveness at $p<0.001$. Therefore, condition 1 is met. In the second step, the independent variables (technological capability and commitment to logistics integration) affect information sharing, the mediator at $p<0.001$ in the entire sub models, hence meeting the second condition of mediation. In the third step, the mediator - information sharing affects global supply chain competitiveness at $p<0.001$, hence meeting the third condition. In the fourth step, information sharing is significantly related to global supply chain competitiveness at $p<0.001$ (full model), and the effect of the independent variable was less in the fourth equation. Hence, the results largely support H6 that postulates that information sharing is a mediator between the antecedents and global supply chain competitiveness.

Table 5: Mediation Tests Using PLS

	Full model		β	Model 1	β	Model 4
	B	t-value		t-value		t-value
H6 Mediation test: Step 1- Independent Variables to Dependent Variables						
GSß----TC	0.11	1.25	0.55	6.34***		
GSß----LC	0.43	4.09***			0.51	6.12***
		$R2 =0.41$		$R2 =0.31$		$R2 =0.29$
H6 Mediation test: Step 2- Independent Variables to Mediator						
IS ß----TC	0.38	4.43***	0.42	3.99***		
IS ß----LC	0.41	3.92***			0.66	7.22***
		$R2 =0.56$		$R2 =0.41$		$R2 =0.61$
H6 Mediation test: Step 3 Mediator to Dependent Variable						
GSß----IS	0.77	8.21***				
		$R2 =0.66$				

CONCLUSION

This study attempted to determine the impact of technological capability and commitment to logistics integration on global supply chain competitiveness. This research also extends prior empirical work by investigating the role of information sharing as a mediator between the two variables. The findings illustrate information sharing among supply chain partners as a technologically oriented issue, which is motivated by advanced IT applications and other technological resources. Firms in the sample which possessed technological capability are more willing to share information with their suppliers and customers, since they have the competence to leverage the existing IT infrastructure and resources. This finding is supported by prior empirical works conducted by Rajaguru and Matanda (2013). While prior researches indicate that technological capability is needed to achieve superior supply chain capabilities, the present study demonstrates this element to be insignificant. However, this study supports the possible influence of technological capability on global supply chain competitiveness through information sharing. This finding implies that whilst the local manufacturing firms possess information technology infrastructures that are congruent with supply chain partners', and possess advanced technological resources, they should share information to help maximise supply chain benefits. As a mediator, the information sharing facilitates in explaining why many firms that have invested heavily in information technology have failed to realise the benefits of these investments.

As predicted, this study finds empirical support for the relationship between commitment to logistics integration and information sharing as well as global supply chain competitiveness. With increased geographical distance, the local manufacturing firms need to integrate their logistics functions with supply chain partners using information sharing. By having these capabilities, local firms not only can avoid delays in delivery, but would also assist them in maintaining the quality of products and in complying with product safety requirements. In global supply chains, the local firms are commonly not able to communicate directly with the end consumers making them lose touch with the actual market demands, which may be translated into wide swings, causing a bullwhip effect. Yet, with the mutual sharing of business and market information between supply chain partners, this issue could be resolved. The accurate information flows on actual demand

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will reduce the need for the manufacturing firms to carry large quantities of inventories to cater for the irregular supply and demand patterns.

Whilst this study could extend prior literature on global supply chains, the present research has some limitations. First, as this study was conducted in Malaysia, there may be certain characteristics of Malaysian firms that might not apply to other countries, which raise the issue of generalisation. Second, since the sampling frame was obtained from the MATRADE Directory, where the population was restricted to only manufacturers that were registered with the agency, the results may be confounded to some degree of external validity. Despite these limitations, it is believed that this study offers important implications for manufacturing firms that are competing in global supply chains from the perspective of a developing country.

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