INTERNAL AND EXTERNAL INTEGRATION: STRATEGIES FOR LOGISTICS COMPETITIVENESS

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ABSTRACT
Logistics management has transcended over the decades into a strategy for competitive advantage in organisational performance and supply chain efficiency. Most industries are recognising that substantial savings are available to companies that are able to coordinate and improve within their logistics operations. Organisations today face great challenges because the successful provision of many goods and services requires the effective integration of logistics activities across a lengthening supply chain and an increasing geographical separation. Furthermore, logistics integration philosophy involves both internal and external integration for a coordinated, unified process as well as relationships to respond flexibly, innovatively, and rapidly to shifting and splintering market demand. The key objective of this study was to investigate how logistics firms integrate their operations both internally and externally for competitiveness in the supply chain. The findings depicted the need for a holistic approach enabling organisational effectiveness and supply chain efficiencies.

Keywords: *Logistics and operations strategy, supply chain management, integration, case studies*

INTRODUCTION

Supply chain integration is known to increase efficiencies, performance and competitiveness (Shapiro, 1984; Christopher 1998). This integration philosophy involves both internal and external integration. Internal integration involves the coordination, collaboration and integration of logistics activities with other functional areas in an organisation; whilst external integration requires the integration of logistics activities with those of their customer and suppliers in the supply chain (Stock *et al*, 1998). According to Stevens (1989), firms need to integrate their operations and functions internally before embarking on external strategies to gain supply chain excellence. This paper presents the findings of internal and

external integration initiatives in ten organisations that are subsequently seeking to pursue superior logistics performance in various distribution centres as well as in supply chains.

LITERATURE REVIEW

Logistics Strategy

Logistics is increasingly being considered as a means for firms to create customer value (Langley and Holcombe, 1992). It is more than just a function or a cost centre to a firm, and has become an integral part of the overall business strategy (Mollenkopf and Dapiran, 2005). The scope and role of logistics have changed from a supportive role to primary functions such as marketing and manufacturing to cover various areas such as warehousing and transportation activities, purchasing, distribution, inventory management, packaging, manufacturing, and even customer service (Bowersox *et al*, 2007). In particular, logistics management has transcended from a passive, cost-absorbing function to that of a strategic factor which provides a unique competitive advantage (Bowersox *et al*, 2007; Bowersox and Daugherty, 1995; Christopher, 1998). Logistics activities are an extension of physical-distribution management and usually pertain to the management of the materials, money and information stream of a business, down through a distribution channel, to the end customers.

In the logistics industry, it is widely accepted that the distribution method and time of delivery determine competitiveness for a company. Logistics strategies have been articulated by various authors over the decades from a corporate strategy perspective (Heskett, 1977); prescribed activities (Kohn *et al*, 1990; McGinnis and Kohn, 2002), strategic orientations (Bowersox and Daugherty, 1987), value chain approach (Porter, 1985) resource-based theory (Lynch *et al*, 2000) and competencies and capabilities (Bowersox *et al*, 1999). Given the rising importance of logistics as a strategy to firm and supply chain overall performance, additional research findings have supported the focus of supply chain logistical integration (Stank *et al*, 2001).

Logistics Integration

Integration can be defined as the combining and coordinating of separate parts or elements into a unified whole. Webster (1966 as cited in Germain and Iyer, 2006; pp. 32) specifies “the unified control of a number of successive or similar economic or especially industrial processes formerly carried on independently”. They further illustrate that firms who are not internally integrated comprise logistics activities as fragmented and often uncoordinated, and spread throughout various organisational functions with each individual function having its own budget and its own set of priorities and measurements

(Lambert and Stock, 1993). Internal integration therefore means unifying functions and processes within the firm especially in the areas of warehousing, transportation, inventory management, purchasing, demand planning and production. In order to integrate internal operations, firms need to have cross-functional structures because cross-functional inputs necessitate the consideration of how coordination and integration can be sustained across this intra-firm relationship. This can be achieved with an appropriate organisational structure with fewer formalities, more empowerment and work teams. The nature of logistics is such that it involves intricacy, extensive documentation and detailed management. There is a need to streamline operations and redesign work routines and processes to eliminate redundancy of work. This allows savings of cost and time, and increases the quality of services, and ultimately value to customers (Bowersox *et al*, 1999).

External integration refers to unified control of functions and processes across trading partners. Upstream examples include the sharing of production plans and costs with suppliers, while downstream examples include the various shared information and processes associated with collaborative planning, forecasting and replenishment." (Germain and Iyer, 2006; p. 32). Virtual integration refers to a temporary tightly coupled collaboration effort between independent entities (suppliers, customers, competitors) that are linked by telecommunication technology. This technology facilitates the sharing of costs, skills and access to global markets (Byrne, 1993). Some of the attributes discussed in the literature on virtual collaboration include the use of information networks to maintain firstly, the connectivity of the participants during the relationship; and secondly, dissolution of the network once the companies have met the specific market opportunity. Barrat (2004) and Simatupang and Sridharan (2002) proposed horizontal, vertical and lateral integration as forms of supply chain integration strategies. Horizontal integration occurs when two or more unrelated or competing organisations (at the same level of the supply chain) producing similar products or different components of one product, form a cooperative association to share resources such as warehouse space and manufacturing capacity (Simatupang and Sridharan, 2002). These have resulted in reduced logistics and administration costs for individual organisations; improved procurement terms through group purchasing power; lowering of the fixed costs of indirect labour (e.g. marketing, quality assurance, technical, sales and financial departments); improved access to markets because continuity of supply can be assured. Vertical integration takes place at different levels of the supply chain. The integration between producer and the distributor enables better physical and information flows, improvements in the trade-off between level of service and average stock, more economical inventory management control and better transportation systems (Caputo and Mininno, 1996). Lateral collaboration combines the benefits and sharing capabilities of both vertical and horizontal integration. Integrated logistics and intermodal transport are examples of an application of lateral integration that aims at

synchronising carriers and shippers of multifirms in a seamless effective freight transport network (Simatupang and Sridharan, 2002).

Research by Stank *et al* (2001) and Gimenez and Ventura (2005) examine the different levels of integration from the logistics points of view. Integration models were developed to show the positive relationship and correlation between internal and external integration. Similarly Gimenez (2006) adopted a similar framework to study the relationship between integration process and performance especially in the interfaces of logistics-marketing and logistics-production. Her study reinforced the integration process as a key aspect of business success and support that firms must achieve a relatively high level of collaboration among internal functions before initiating any external integration. This is congruent with Lambert *et al* (1998) who posit internal integration as a prerequisite for successful supply chain management. Firms have been compelled to restructure both internal and external relationships to respond flexibly, innovatively, and rapidly to shifting and splintering market demand (Chapman *et al*, 2003). Similarly, firms build capabilities by reflecting the value of the work's performance and applying integrative principles that allow multiple processes to be synchronised. This ability to link internal operations affirms the dynamic development and leveraging of proficiencies within the firm (Bowersox *et al*, 1999). In doing so, organisations can then implement their strategies and satisfy customer requirements. Managers have to consider the market, customers' needs as well as resources to plan the coordinated efforts and manage holistically. This requires commitment from all employees being aware of this interconnected capability.

METHODOLOGY

The study adopted an iterative process of data collection by conducting ten case studies comprising interviews with senior and middle managers and visits to observe the operations of distribution centres. This method is especially suited to the current research and is used in investigating the integration strategies and capabilities evident in logistics organisations. Case studies of this kind have some limitations in terms of generalisation to population. The strategies, approaches and capabilities of individual firms may have an impact on the interpretations. The findings however are discussed in relation to existing theories (Yin, 2003). Semi-structured interviews were conducted with twenty-three managers in ten organisations. This paper distinguishes the internal and external integration initiatives in logistics firms, the issues faced and their importance for both organisational and supply chain effectiveness. Five of the firms were in Australia (identified as Firms A-E) and another five in Singapore (identified as Firms F-J). Table 1 summarises the nature of these firms' operations as the various managers who participated in the interviews. The case study approach (Yin, 2003) was adopted because to identify some situations in

which all research strategies might be relevant, the 'how' and 'what' questions are asked about a contemporary set of events over which the investigator has little or no control. The research questions are

- *'What were the initiatives undertaken to integrate internal operations in the firms studied?'*
- *What were the actions or strategies adopted to integrate with external partners in the supply chain?*
- *'What were the issues faced?'*
- *'What were the outcomes and benefits of the integration?'*

Firm	No of employees	Organisation Structure	Sales A$ mil	Age of Firm (yrs)	Main functions	Main products	Managers interviewed
A	36	Part of a large company group	80	25	Warehousing & Distribution (of finished goods)	Hardware, PC & Appliances	- General Manager - Administration Manager - Human Resource Manager
B	200	Part of a large company group	30	5	Assembling, Warehousing & Distribution (of finished goods)	Automobiles	- Regional Manager - Human Resource Manager - Quality Assessor
C	470	Subsidiary of a multi-national Corporation	350	50	Warehousing, Distribution, Import, Export (of raw materials & finished goods)	Refrigerated foods	- Director of Operations, Australasia - Regional Manager, Australia - Director of IT, Australasia
D	11	Single privately owned business	4.2 (est.)	0.5	Warehousing, Distribution, Import, Export (of raw materials & finished goods)	Varied	- General Manager
E	100	Single privately owned business	230	6	Warehousing & Distribution (of finished goods)	Refrigerated foods	- Operations Manager - Human Resource Manager - Warehouse Manager
F	150	Subsidiary of a multi-national Corporation	234	5	Assembling, Warehousing and Distribution (of finished goods)	Varied	- Managing Director - Operations Manager - Human Resource Manager
G	250	Single company in a public ownership	25	23	Manufacturing, Assembling, Warehousing and Distribution (of raw materials)	Electrical, fibre optic & computer peripherals	- Logistics and Warehouse Manager - Production Manager
H	200	Subsidiary of a multi-national Corporation	158	24	Warehousing and Distribution (of raw materials & finished goods)	Varied	- General Manager
I	320	Single privately owned business	320	6	Warehousing and Distribution (of raw materials & finished goods)	Varied	- Assistant Manager, Regional Operations - IT Manager
J	115	Subsidiary of a multi-national Corporation	68.9	27	Warehousing and Distribution (of finished goods)	Rolling bearings and seals	- Managing Director - Logistics Manager

Table 1 Overview of firms studied

As the study seeks to address research questions, this suggests the adoption of an exploratory approach. Yin (2003) notes that exploratory studies are primarily useful for the generation of hypotheses centred on the phenomena under investigation. It was also anticipated that the research would result in the emergence of further theory and hypotheses to guide future research in the area. A multiple case study approach allowed the researchers to test the congruency or fit of the 'real world' to the factors identified. This method helped to ensure the reliability of cross-organisation and cross-site comparisons between Singapore and Australia, as well as of analysis. The use of multiple sites also contributed to the reliability of the findings (Bygrave, 1989). The qualitative approach and exploratory nature of the research question influenced the data-collection method. Research conducted within the qualitative paradigm is characterised by its commitment to collecting data from the context in which social phenomena naturally occur and to generating an understanding that is grounded in the perspectives of research participants (Bryman, 1988; Lofland, 1971; Marshall and Rossman, 1995; Miles and Huberman, 1984). Consequently, the data was collected from participants in their working environment using semi-structured interviews. This method allowed the capture of data rich in detail about the research problem; and gave the researchers the flexibility to explore additional issues raised by participants. Due to the qualitative research approach adopted and the exploratory nature of this study, the data were collected first-hand. The researchers chose self-collection of data to develop a grounded understanding of integration strategies, initiatives and processes in the distribution centres, and to meet the aims and objectives of the study (Shaw, 1999).

FINDINGS

It was found that the firms studied adopted various initiatives to integrate their operations both within the organisation and with supply chain partners. Several of the main findings of this study are outlined as follow:

Internal Integration

Streamlining the vision and mission of the organisation

The operations of any organisation depend on the overall goals and direction of the firm. From there, strategies are set in line with the operations of the firm. Managers interviewed were asked to elaborate on the company mission or vision. Eight firms focused on serving customers as first priority. The other firms envisioned being market leaders through growth, efficiency and continuous improvement activities. There was also focus on serving employees through training and development, and in areas of quality, occupational health and safety. Two firms' missions included increasing profits to shareholders and

concerns for environmental issues. The managers also indicated that reducing costs and improving quality in their distribution centres were included in their organisations mission statements.

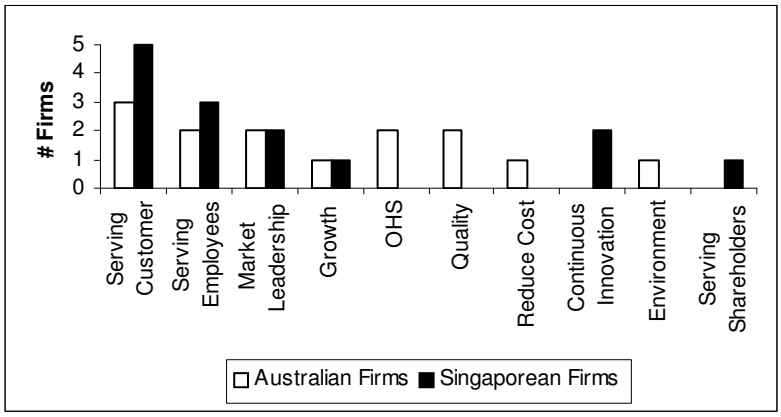

Figure 1 Target areas for company mission/vision

Imposing organisational policies and procedures

The ability to link and integrate systems and processes depends highly on organisational policies and procedures. A policy addresses major operational issues whereas a procedure is a narrower application, generally stated in detail and described as a process. The importance of procedures is to establish corporate-wide standards across diverse practices of the organisation, and describe the details of processes and systems in place. This is crucial for the effective integration of operations across departments. All the departments (except those in Firm A) of the ten firms had standardised policies and procedures. Firm A relied on the broad corporate policies set by headquarters bi-annually. The organisational policies and procedures targeted at various areas and are illustrated in Table 2 following.

Target areas	Firms									
	Australian					Singaporean				
	A	B	C	D	E	F	G	H	I	J
Occupational health and safety	X	X	X	X				X		
Operations/Work practices	X	X		X		X	X		X	X
Management	X								X	
Quality / ISO certified practices		X	X		X	X	X	X	X	
Environmental issues			X		X		X			
Training					X					
Contingency plans			X							
No smoking/alcohol/drugs at workplace			X							
Planning									X	

Table 2 Target areas in policies and procedures of firms

The above suggests that the Australian firms' policies and procedures targeted differing areas to those of the Singaporean firms. Occupational Health and Safety (OHS) was prominent and common among the Australian firms. Only Firm H in Singapore included OHS in its policies and procedures. The

Singaporean firms' policies and procedures placed their emphasis on operations and quality or ISO certifiable practices.

Adopting cross-functional unification across departments

During the interviews, all the managers ascertained cross-functional unification across various departments to streamline operations and work towards common objectives. Unification was obvious through regular meetings, departmental meetings and the directions set by management. There were company-wide objectives set at managerial level and filtered to all departments during periodic meetings. This cross-functional unification across departments can assist synergistic processes and activities in the organisation. Information exchange modes comprised emails and notice boards on departmental costs incurred, profits gained, the goals and directions set for the next quarter, areas for improvement, and how they can make operations more transparent among the departments. Employees and management viewed this exchange of information as a connection and to have an overall picture of the direction of the firm.

Streamlining logistics operations and managing efficiency

Receiving and despatching goods: Coordination between departments was found to be crucial for streamlining processes and systems at the distribution centres. For example, the procurement or administration department was directly linked with the distribution centre in managing inventory. Different firms had different ways of handling stock because of the nature of goods and size of firms. They involved receiving docks, loading, unloading and time spent counting and inspecting goods. Order fulfilment accuracy was critical for customer satisfaction, and these firms attempted to effectively integrate their inventory management for this.

Controlling defective and damaged goods: The managers interviewed explained that damage was predominantly caused by mishandling during despatching, or insecure packaging material when received. These firms took measures to minimise losses to the firm by holding employees accountable for the stock they mishandled or despatched to customers. In addition, they had to be very aware of the shelf life or expiry dates of products, and needed to have effective stock control to manage this. Firm J, being a manufacturing firm experienced errors or defective products from the manufacturing process. The managers reported that defective or damaged goods can be controlled through employee training, proper supervision or other methods. Firm B which dealt with automobiles highlighted and displayed employees' mistakes. Firm I used prominent posters and reminders for efficient handling in the distribution centre. Firm G ensured proper usage of box pallets and shrink-wrapping cartons to prevent

damage to products. In Firm H, the layout of the distribution centre influenced the condition of goods. Well-designed racks and shelves were utilised, capable of sustaining the weight and dimensions of goods.

Inventory Management: To minimise inventory shrinkage, the firms took appropriate measures such as physical stock counts, cycle counting (adopted in Firms C, G, H and I) and barcoding for easier monitoring. In Firms H and J, the responsibility was assigned to employees. Stockkeepers were held accountable for items handled. The goods were labelled with the employee's identification for tracking and reference, should a missing stock situation arise. Firms G and J adopted the Automated Storage and Retrieval System software (ASRS) which made it easier to control and monitor inventory.

Provision for growth and expansion

Eight out of the ten firms interviewed (all except Firms G and I) provided for growth and expansion of the distribution centre. The structure and layout of these distribution centres had been designed to accommodate for expansion. Firms B, D, E and H purchased extra land space adjoining the property for future construction. Firm C, on the other hand, was prepared to relocate the distribution centre and distribution facilities. The other firms intended to provide for this by better racking systems, extra or extendable shelving, and bulk storage. The managers indicated that they had to be proactive and look into the future. Eight of the ten firms' managers were optimistic about the expansion of their distribution centres, because of the buoyant logistics industry and increasing turnover.

Restructuring the organisation

All the managers interviewed affirmed that the organisation structure allowed for cross-functional activities and operations. There was easy access between departments and information was shared or exchanged internally. All the firms, but two (Firms E and J) had restructured their organisation within the last five years. Every manager of the eight firms affected stated that this change was beneficial and assisted to streamline internal operations and enabled employees to be multi-skilled, flexible and react quickly to market changes.

External Integration

Maintaining standardised operations

The firms studied practised standardised operations with most customers and suppliers. The managers maintained these through documentation or Standard Operating Procedures (SOP). Regular meetings were held with suppliers and customers to update or reflect changes in the documentation on environmental or technological improvements. Firms F and H faced problems with the smaller customers who needed

modifications regularly, depending on their production type. These smaller customers have difficulty interfacing with their operating systems. There was variation for reporting, invoicing, closing of accounts, and special personnel involved. The warehouse manager in Firm E expressed concern that smaller customers' agreements were mainly verbal and inconsistent over time.

Joint planning with customers and suppliers

All firms (except Firm E) had some form of joint planning with their customers and suppliers in marketing and inventory management. They were able to gauge sales forecasts, plan on new product launches and ensure appropriate stock levels. Firms G and J that were involved in manufacturing, planned for production schedules and forecasts. The production managers in these firms mentioned that they joint planned with suppliers in using Material Requirements Planning (MRP), Vendor Managed Inventory (VMI) and with customers on the marketing of new products and Just-In-Time (JIT) delivery. By joint planning with customers, firms could design ways to carry out operations with minimum interference, and effectively manage inventory at the distribution centre by making provisions for huge volumes or excess capacity storage. There were joint plans in Firms B, C and D with suppliers in setting benchmarks and Key Performance Indicators (KPI). The operations manager in Firm F described plans with suppliers on interfacing with each other and how to increase efficiencies.

Sharing knowledge with customers and suppliers

All the firms, except for Firm H shared knowledge with their suppliers and customers to various extents. In Firm A, the exchange of knowledge was with selected key suppliers only. They included aspects of promotional events, buying group seminars and conferences. Firm A was also able to access supplier databases. In turn, they shared strategic information with suppliers on customer orders, to let them know how much stock to produce. Firm B exchanged information on their documented processes which included installation notes, rates chargeable for fitting accessories to vehicles (such as installing a CD player, various models of stereo system, or an aerial on the vehicle). Firm C adopted a Balance Scorecard approach and shared knowledge which entailed information from the company vision, strategies, critical success factors and measures on how to achieve them. Firm E provided smaller customers advice and assistance in transportation, despatch issues and technology application. The operations manager in Firm F stated that information was made available only to subscribed customers and suppliers with special access to their website. The website contained information relating to their distribution centre management system, inventory system, and operations. Strategic and financial information was limited to published material in annual reports, press conferences, magazines and newsletters. The managing director at Firm J

reported that certain strategic information was shared only at annual conventions, conferences, and seminars, where they were invited to present and impart their experiences with other organisations.

Sharing processes with customers and suppliers

The findings showed that only Firms A, C, E, I shared processes; but to a small extent only. Firm A provided training for its customers to enable them to gain a better understanding of what their requirements are, and to use the right terminology in future orders. Firm C shared processes on purchasing and some management aspects, whist Firm E engaged in quality management process and HACCP with their suppliers. Firm I alternatively, collaborated with partners on recycling. The IT manager explained the incentives where customers obtain discounts on the future service charges for pallet returns. Other incentives were given to customers in reverse logistics such as the refurbishment and minor rework of damaged products. This was to get them back into saleable condition. These schemes enabled customers to be more proactive in observing policies and procedures that they have set, as explained by the managers.

Joint investing with customers and suppliers

The findings show that half the firms studied joint invested with suppliers and customers in the areas of technology (30%), capital investment (30%), R&D (20%), VMI (10%) and marketing (10%). The highest areas of investments with suppliers and customers were in technology and capital investment. Some firms saw the need to keep abreast with technology for better communication, and coordination of processes. Interfacing with partners in the supply chain maximised efficiency and sped up processes. Firm A had jointly invested with some suppliers in the installation of Electronic Data Interchange (EDI). Other firms maintained the importance of technology and expertise in ICT. Firm I invested in their customers by financing the installation of new software (SAP) and then amortising it over the contractual period, so that customers could pay back in instalments. Capital investment was evident in Firms B, C and I; and included long-term projects, equipment and storage facilities. Firm A jointly invested in marketing projects. They rendered assistance to suppliers for advertising building materials and new product introduction. Only Firms G and J that dealt with production and manufacturing, had some joint investment in R&D. In both these firms, the managers mentioned the benefits of sharing costs with some customers on innovation projects, new product development and production methods. Firm G invested with some customers on VMI. This method offered many benefits including substantial cost savings due to more efficient control of inventory. In addition, it provides extensive screen enquiry and reporting functions to give the detailed, current information about quantities, prices, item movements and sales history that are crucial for effective inventory management.

Synchronising and interfacing with customers and suppliers

All firms (except Firm D) had some form of operational synchronisation and interface with their suppliers and customers. Firm D still maintained the traditional method of receiving orders through telephone and facsimile and administered paperwork. The other nine firms linked through ICT to operate and communicate via web-based, intranet, internet, or EDI. However not all customers or suppliers were able to interface this way. The information for those smaller firms had to be keyed in manually. Managers in Firm J explained the need to use two different software packages for different processes. For instance, customer service operations deployed an in-house system. It was different for the distribution system, warehouse management system, factory manufacturing planning system and transportation system, which used another system and was linked to supply chain partners. The logistics manager expressed the view that a few of their international customers adopted different and incompatible systems. As a result they had to rely on other forms of data exchange such as facsimiles. Apparently, this was manageable and not considered a big issue, as the number was small. Again synchronising and improving the interfaces between partners in supply chains removes barriers to communication and learning, and enhances the opportunity to innovate either individually or jointly.

DISCUSSION

The case studies found that the primary motivation for internal integration was effective business operations, which simultaneously helped to minimise total distribution costs and maintain customer satisfaction. Each firm differed in their own implementation of integration activities because of their contingency factors, policies, procedures or strategies adopted. The coordination of activities among departments mandated the consideration of firm objectives as a whole, rather than those of individual departments. Ultimately, firms should work towards the satisfaction of customers. The external integration with suppliers and customers enabled firms to set procedures in their dealings with partners, shared knowledge and processes, and subsequently joint-planned and invested with them for better operations, systems and processes in the supply chain. Studies have shown that the logistical and cost effectiveness of internal integration are actually a driving force for organisations seeking external integration opportunities (Germain and Iyer, 2006). However not all firms or supply chains achieve such excellences due to various reasons. The barriers to achieving successful integration as suggested by Germain and Iyer (2006) are predominantly the dynamic nature of markets, product-market combinations, coercive supply chain partners and the turnover rate of senior managers. There are several managerial implications from this preliminary study on the integration philosophy in logistics and supply chain management. Firstly, while external integration without internal integration may seem effective through

operational improvements, the long-term performance will show otherwise. Studies by Germain and Iyer (2006) and Rodrigues *et al* (2004) ascertain the need for both internal and external integration in order to reap the financial benefits from this logistics strategy. The key is for managers to understand that integration should be undertaken both internally within the organisation and externally downstream with partners in the supply chain for better competitiveness and profitability.

It is acknowledged that there are some limitations to the study. This research into the initiatives to integrate internal and external operations in the firms was essentially exploratory. Further research needs to be undertaken to investigate the views of employees at the operational level and supply chain partners as we feel the managers tended to present somewhat optimistic and possibly biased views, most of the time portraying their firms to be successful and innovative. These should be verified by examination of the firms' actual performance and through the perspectives of the supply chain partners. The challenge facing distribution centres is to strategically integrate their operations and collaborate with supply chain partners at the same time such that they are able to meet the demands of this dynamic industry. Management is conscious of the need to determine and prioritise efforts to save costs and satisfy customers, and concurrently align operations strategically along the supply chain. They placed some validity on the efficiency of operations with a commitment to improvements and competitiveness. These findings are important as they provide some insight as to how firms differed in strategies and effectiveness. In addition, they also have significance for management in considering and assessing their efforts, and to supplement their setting of goals and strategies. By improving logistics operations, organisations can realise greater production, increased efficiencies, and technological competencies beyond their geographic borders.

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