Logistics management requirements and logistics performance efficiency: the role of logistics management practices – evidence from Egypt

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Abstract: This study examines the availability of logistics management requirements, i.e., organisational requirements (OR), informational requirements (IR) and human resource requirements (HRR) and their impact on logistics performance efficiency, particularly the mediation effects of logistics management practices in this relationship within Egyptian engineering industries firms. Data is collected based on a survey questionnaire directed to 194 observations within the selected firms. The operating costs average is used as an indicator of the logistics performance efficiency since it measures the efficiency inversely. Our findings reveal significant variations in managers' perception of logistics management concept among the selected firms. The findings also reveal significant differences among the selected Egyptian corporations according to the availability degree of logistics management requirements and practices. At the same time, the study partially supports the significant impact of logistics management requirements on logistics performance efficiency where logistics management practices play full and partial mediating roles in this relationship.

Keywords: logistics management requirements; LMRs; logistics management practices; LMPs; logistics performance efficiency; emerging markets; Egypt.

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1 Introduction

A substantial number of studies have been emerged over the last decades to investigate the role of logistics management in meeting customers' needs and requirements (Bottani and Rizzi, 2006; Farhat, 2009; Wu and Hou, 2010; Ramanathan, 2010; Liu, 2011; Erkan, 2014; Nyaberi and Mwangangi, 2014). The underlying assumption of this trend of research is that the successful management of different logistics activities [e.g., inventory management, warehousing operations, material requirement planning (MRP), purchasing, transportation, quality control, physical distribution of final outputs, handling and packaging processes and logistics information systems (LIS)] has a vital role in creating and enhancing the organisational competitiveness (Cavinato, 1992; Sarkis and Park, 2008; Ketikidis et al., 2008; Ibrahim, 2008; Aiyedun, 2012). According to Vail (1994), costs of logistics businesses may reach 30% of the annual sales revenues and approximately ranges 50% to 60% of total operating costs. Accordingly, successful logistics operations not only enable organisations reach market rapidly, with delivery of competitive products, but it may also reduce the total cost of these products while simultaneously improving customer satisfaction. In this regard, Tracey (1998) indicates that offering competitive prices mainly depend on logistics expense incurred across the supply chain and the level of logistics services provided. Moreover, logistics management process is considered to be one of the modern aspects in management in facing numerous economical, technological and informational challenges (Nilsson, 2006; Ketikidis et al., 2008).

This has led to a growing consensus on the importance of logistics management as the part of supply chain management in ensuring the effective and efficient flows of goods, services, materials and related information along the supply chain (Cooper and Ellram, 1993; Edris, 2003; Christopher, 2011; Roushdy, 2012). In this context, El-wakil (2003), Christopher (1998) and Murphy et al. (2011) point out that the achievement of logistics management enhances the competitive advantage of business organisation by either adopting the value advantage approach or the reduction of production cost. By investigating the theoretical and practical researches in that field, there is a scarcity of studies regarding the investigation of the association between logistics management requirements (LMRs)[1], logistics management practices (LMPs)[2] and logistics performance efficiency.[3] However, there are some studies indicated to the existence of such relationships theoretically, but also no study proves it practically (Vail, 1994; El-wakil, 2003; Tseng et al., 2005; Liu, 2011; Mohan, 2013; Ralston et al., 2013; Erkan, 2014). Therefore, the present study contributes to the academic literature by, first, recognising the availability degree of the LMRs within the Egyptian engineering industries firms. Second, the study tests the significant differences among the respondents' opinions regarding their awareness of logistics management concept. Third,

investigating the relationship between the logistics requirements and LMPs and testing their influence on logistics performance efficiency. Fourth and perhaps most importantly, the study tests for the first time within the Egyptian context the mediation relationship of LMPs between logistics requirements and logistics performance efficiency for industrial engineering organisations since the majority of Egyptian studies are mainly focused in the role of logistics in ports (service sector) only. Finally, in order to enhancing the logistics performance efficiency, the current study is also motivated to propose an integrated framework for the logistics management system within the Egyptian industrial engineering organisations.

The remainder of this paper is structured as follows. Section 2 reviews the literature and develops hypotheses. Methods of data collection and information sources, as well as the empirical estimate for LMRs, practices and logistics performance efficiency are presented in Section 3. Section 4 discusses the results of univariate, multivariate analyses and mediation effects and finally, the research conclusions and suggestions for future work are presented in Section 5.

2 Literature review and hypotheses development

Over recent decades, a significant amount of empirical research has become more concerned with the importance of logistics management from different perspectives involving managers' awareness of such concept, availability of LMRs, LMPs and logistics performance efficiency (see Vegetti et al., 2005; Sarkis and Park, 2008; Aiyedun, 2012; Ralston et al., 2013; Erkan, 2014; Nyaberi and Mwangangi, 2014). The importance of logistics management cannot be underrated at both of global and domestic levels. At global level, Erkan (2014) indicates that logistics activities costs range between 9% to 20% of the GDP. Any substantial improvements related to logistics activities might reduce both of production and transportation costs which consequently enhance the country's comparative advantage. Therefore, logistics management should be the core business of formulating, designing and processing logistics practices in order to enhance organisation's efficiency and sustain competitive advantage (Nyaberi and Mwangangi, 2014).

Numerous empirical researches have been increasingly investigated how to improve the efficiency and effectiveness of logistics (Bottani and Rizzi, 2006; Wu and Hou, 2010; Liu, 2011; Erkan, 2014). In this context, Tseng et al. (2005) examine the association between transportation and logistics system. The results reveal that transportation and logistics system have interdependent relationships. The improvement of transport efficiency would change the overall logistics performance. In addition, Aiyedun (2012) investigates the role of logistics in product distribution to pursue efficiency. Four variables including inventory control, logistics improvements, supply chain management system and system performance improvements are found to be highly essential for success of supply chain management.

Regarding LMRs, i.e., informational requirements (IR), human resource requirements (HRR) and organisational requirements (OR), prior research has investigated the role of IR in enhancing logistics performance (Rutner et al., 2003; El-Miligy, 2003; Power, 2005; Sarkis and Park, 2008; Vegetti et al., 2005). They conclude that there is an increasing importance for utilising information technology (IT) within logistics activities

to pursue efficiency. Loh et al. (2006) point out that the adoption of extended enterprise applications (EEA) – as a modification of enterprise resource planning (ERP) system – can increase the supply chain information velocity and reduce the cost of doing business. According to Radhakrishnan et al. (2008), the use of appropriate information system leads to the creation of differential business value. Han et al. (2009) point out that both of integrated IT and integrated logistics management indirectly affect firm performance of the pork processors through improving the quality management practices. Wilson et al. (2015) assert the usage of IT in increasing the performance of logistics firms in Nairobi County. Bae (2016) also verifies the role of LIS as a moderator factor in enhancing the association between inter-organisational collaboration and performance within Korean shipping and logistics firms. Such growing tendency among firms, especially the logistics firms to adopt IT applications is due to the ability of IT to enhance firms' operational excellence, remove inefficiency and improve customer service. In a highly competitive environment, Sauvage (2003) indicates that the technological ability of third-party logistics providers is a key element for sustaining a successful logistics outsourcing relationship. At the same time, such technological ability in enhancing the supply chain reactivity becomes the main determinant for differentiation between different logistics providers.

In the context of human resources requirements and their impact on logistics efficiency, Bowersox et al. (1989) conclude that human resource development directly affects the success of supply chain management practices. Ding et al. (2015) argue that shortage of logistics human resources and lack of logistics expertise are the main factors for operational inefficiency in the Chinese logistics service market. They also conclude that human resources practices including training and development, recruitment and selection significantly affect logistics and supply chain competencies. Othman and Ghani (2008) also indicate that developing an overall human resources management policy is one of critical factors for successful and effective implementation of supply chain management. In addition, the adoption of effective HRM practices enhances firms' managers to fulfil their role in logistics and supply chain industry (Gowen and Tallon, 2002; Shub and Stonebraker, 2009). According to Wellins and Rioux (2000), modern practices of HRM must be proactively applied to a firm's supply chain. In this regard, Jhawar et al. (2014) show that investment in human resources (e.g., training, working conditions, welfare and wages) enhances the availability of skilled workforce which in turn reduces logistics cost, logistics time and accidents level. However, a little research has been done to investigate how OR of logistic management affect the logistics performance in terms of efficiency and effectiveness.

From the perspective of LMPs, Tracey (1998) finds a positive association between logistics processes efficiency (e.g., physical supply, physical distribution and logistics spanning process) and customer service. Moreover, logistics processes positively affect firm performance where customer service mediates this relationship. Green et al. (2008) indicates the intermediary positive effect of supply chain management strategy and logistics performance on firm's financial performance through improving firm's marketing performance. Ibrahim et al. (2010) also find a reasonable moderate correlation between supply chain management practices and firm performance. At the same time, Al-Shboul et al. (2017) shed light on a direct/indirect relationship among supply chain management practices, supply chain performance and firm's performance. They indicate that the supply chain management practices have a positive direct impact on manufacturing firm's performance. At the same time, such practices have a positive

impact on supply chain performance which in turn positively enhances firm's performance. Recently, Qadir and Ali (2017) conclude that logistics processes positively affect both of customer service and firm performance based on data related to the furniture industry of Pakistan. Taken together, these above mentioned studies try to investigate how the availability of LMRs and the adoption of LMPs are essential for improving logistics performance efficiency and organisational performance within specific industrial and country contexts. From this view point, the association between LMRs, practices and logistics efficiency can be justified by a strategic choice theory. Firms can improve their logistics efficiency by following their chosen strategy which considers LMRs and practices. Accordingly, both of LMRs and practices can be considered as strategic choices through which a firm can achieve operational excellence, efficiency and profitability. However, despite this, there is still scarcity in studies that investigate the impact of LMPs as a mediator factor on the association between LMRs and logistics performance efficiency. In order to develop and adopt a solid competitive logistics strategy, particularly in developing countries, the current study aims to shed light on a direct/indirect relationships among LMRs, LMPs and logistics management efficiency.

In the Egyptian context, El-Wakil (2003) evaluates how the improvements of logistics performance could enhance the competitive advantage of the Egyptian exports. The results reveal that logistics management enhances organisations capabilities to achieve both of productivity and value advantages. El-Miligy (2003) demonstrates that using electronic commerce (e-commerce) applications within Alexandria port community leads to increase productivity, faster decision making and fewer errors. Shaaban (2006) investigates the role of logistics platform activities as a supportive-base for container terminal business in Al Sokhna port. The results indicate that the presence of logistics centres added value by creating time place utility and also increased the competitive advantage of Al Sokhna port. Farhat (2009) demonstrates that collaboration between logistics centres and Al Sokhna port is crucial for the success of this port. The report of The World Bank logistics performance index (LPI)[4] in 2014, among 160 countries analysed, indicates that the rank of Egypt is 62nd with 2.97 LPI score. The report also shows that Egypt is ranked well in tracking and tracing but less well ranked in the other sub-dimensions of the index. This implies that there is a need to improve management systems, IT and logistics competency within Egyptian environment.

In the light of the above mentioned results, there is scarcity in studies that investigate the association between LMRs, practices and logistics performance efficiency. Therefore, the current study is considered one of the first endeavours to explore the role of logistics management, LMPs, LMRs and logistics management challenges within business industrial organisations in Egypt as an emerging market since the majority of previous studies are concentrated on the role of logistics in ports. The study also clarifies the debate regarding the association among LMRs, LMPs and logistics efficiency. In addition, this study is highly motivated to explore how LMPs affect the association between LMRs and logistics efficiency as little empirical research has examined such impact. The results of study may enable firms' manager to recognise problems and challenges related to logistics management. This can be a corner stone for developing the logistics strategy within these firms for enhancing their logistics efficiency. Based on the literature review and the main research question mentioned above, the current study aims to investigate the following five hypotheses:

H_1 There are significant differences among the selected Egyptian corporations due to their managers' perception of logistics management concept.

H_2 There are significant differences among the selected Egyptian corporations according to the availability degree of LMRs.

H_3 There is a significant impact of the availability of LMRs and practices on logistics performance efficiency.

H_4 LMRs are positively associated with LMPs.

H_5 LMPs mediate the relationship between LMRs and logistics performance efficiency.

3 Methodology

3.1 Dataset and measuring of variables

To test the above stated hypotheses, a questionnaire survey approach is employed to collect data. The population in the current study is only limited to public firms related to engineering industries due to the following reasons:

1 The selected firms give utmost attention to warehousing activities, proper transportation methods, different approaches of how to use raw materials in an optimal way and other activities related to logistics business management

2 Working facilities within engineering industries firms in Egypt reach 21% of the total industrial facilities (Business Sector Information Centre, 2011)

3 Data accessibility within public firms is more available rather than private firms due to the culture of high tendency toward secrecy and confidential within Egyptian private sector.

This leads to impose several constraints regarding filling out the questionnaires and obtaining the required data, especially the operating costs. Ten public firms related to engineering industries represent the population of the current study. Due to the limited size of the target population, the complete census approach is adopted. One hundred ninety-four questionnaires are directed to chief executive officers and heads of department who are responsible for logistics activities in the selected firms. The survey is administered via personal interview with the respondents. Ninety items involving several closed-ended questions are incorporated in the survey to obtain the respondent's opinions on the following logistics management dimensions, a summary of measurement items are listed in Table 1:

- The extent to which logistics management concept is realised (ELM). Following Stank et al. (1999), Christopher (1998), Closs (2000) and Nilsson (2006), 16 items have been developed to assess managers' perception of logistics management concept.
- The availability of LMRs, as independent variables consists of three sub-dimensions:
  a OR which are measured through eight items based on the work of Stank et al. (1994), Henry (2011) and Lin and Ho (2011).

b HRR that are measured by 16 items adapted from previous studies (e.g., Bowersox et al., 1989; Hunter et al., 1996; Gowen and Tallon, 2002; Li et al., 2006; Shub and Stonebraker, 2009; Anastasiou, 2012; Ralston et al., 2013; Jhawar et al., 2014).

c IR are assessed using 14 items derived from the work of Motwani et al. (2000), Krishnan (2001), Koh et al. (2006), Loh et al. (2006) and Ketikidis et al. (2008).

- LMPs as the mediator variable are measured via 28 items which are drown upon studies of Tracey (1998), Ketikidis et al. (2008) and Lin and Ho (2011). We should note that all of the abovementioned dimensions (managers' awareness of logistics management concept, LMRs and LMPs have been assessed based on five-point Likert-style response ranged from 1 = 'not available at all' to 5 = 'available with a high degree'.
- Challenges and problems (CPs) face organisation when applying logistics management. Following Ketikidis et al. (2008), they have been assessed by eight items. These items are assessed based on 5-point Likert scale ranged from 1 = 'absolutely not agree' to 5 = 'completely agree'.

Regarding the assessment of logistics efficiency, logistics cost plays an important role in achieving competitiveness on both macro and micro levels (Zhao and Tang, 2009; Havenga, 2010; Asian Development Bank, 2012; Zakariah and Pyeman, 2013). However, the selection of appropriate indicator to measure the logistics efficiency is not a trivial task due to the following reasons:

1 The performance indicators of efficiency can be defined in a variety of ways (e.g., functional area of logistics, the type of enterprise and the view point of logistics services' users) (Kolinska and Cudzilo, 2014). In this regard, Asian Development Bank (2012) proposes – on one hand – the average transit time cargo visibility, transport cost as a percentage of total product cost and percentage of on time deliveries for assessing logistics efficiency at a micro-level. On the other hand, logistics cost as a percentage of gross domestic product can be used as a macro-performance indicator of logistics efficiency. However, the above mentioned indicators are not appropriate within Egyptian environment due to lack of information accuracy and tendency towards secrecy.

2 Numerous additional direct and indirect costs related to logistics function and operations should be considered such as custom duties, insurance, carrying costs, ordering costs, stock out costs and capacity-associated costs. In this regard, Zakariah and Pyeman (2013) propose that the majority of firms in Malaysia assess their logistics cost either as a percentage of sales or the absolute costs. Meanwhile, the minority of these firms assesses their logistics efficiency as per sales unit.

3 Logistics management as a balancing act delivers what customer needs at minimum cost. The achievement of this objective mainly depends on the ability of logistics management to make a tradeoff between the customer service and the cost of providing that service. Following Piasecki (2001) and Bokor (2008, 2012), the selection of appropriate indicator of logistics efficiency should include different types of costs related to logistics operations such as purchases, inventory, warehousing, transportation, distribution of finished products and reverse logistics.

Table 1 Measurement items

Dimensions		*Items and description of scales*	
1	The extent to which logistics management concept is realised 'awareness of logistics management concept' (ELM)	Scale: [1 – not available at all and 5 – available with a high degree]	
		1	Senior managers keen to select and appoint high efficient personnel responsible for logistics activities.
		2	The extent to which senior managers are oriented toward low cost while maintaining high quality.
		3	Your company combine the activities of purchasing, storage, distribution and quality control in a separate department called logistics management department.
		4	Workers in your company adapt to any change happens inside it.
		5	Senior managers are interested in directing workers toward change and training them to solve problem.
		6	Senior managers put in top priorities improving their relationships with suppliers.
		7	Senior managers put in top priorities the participation of all departments in decision making.
		8	The quality system includes documented purchasing system.
		9	Senior managers put in their priorities achieving coordination and integration among all departments in organisation.
		10	There is a system in place to adequately control the handling storage and packaging of products.
		11	Senior managers permit employees' participation in putting plans and programs for their jobs.
		12	Workers are empowered to take decisions on their jobs.
		13	A shipping checklist or other relevant procedure used in order to verify that the order is correct and complete (dropped).
		14	A shipping checklist or other relevant procedure used in order to verify that the preservation and packaging process is correct (dropped).
		15	A shipping checklist or other relevant procedure used in order to verify that the shipping destination is verified (dropped).
		16	Your company use a third- party company that has a role of transportation (dropped).
2	Logistics management requirements (LMRs)	2.1	Organisational requirements (OR)
		Scale: [1 – not available at all and 5 – available with a high degree]	
		1	Company management support and encourage the application of ideas of continuous improvement.
		2	Employees and workers are adapt to any changes inside organisation.
		3	Senior managers are interested in directing workers toward change and training them to solve problems.
		4	Senior managers put the responsible units on raw material management in a first centre of organisational structure.
		5	There is a documented purchasing system in your company.
		6	There is a system in place to adequately control the handling, storage and packaging of products.
		7	The processes of quality assurance, controlling and inspection are separated from production management.
		8	All raw materials, parts and supplies are inspected upon receipt to assure conformance to all requirements of the company.

Table 1 Measurement items (continued)

Dimensions		*Items and description of scales*		
2	Logistics management requirements (LMRs)	2.2	Human resources requirements (HHR)	
		Scale: [1 – not available at all and 5 – available with a high degree]		
			1	Senior managers put in their priorities achieving coordination and integration among all departments in organisation.
			2	Senior managers keen to select and appoint high efficient personnel responsible for logistics activities.
			3	Senior managers put in top priorities improving their relationships with suppliers.
			4	Senior managers put in top priorities the participation of all departments in decision making of the material requirements planning process.
			5	Senior managers permit employees' participation in putting plans and programs for their jobs.
			6	Workers are empowered to take decisions on their jobs.
			7	The company specify a good budget to train employee continuously for the purpose of increasing their job efficiency.
			8	The process of performance evaluation should be fair and objective for all employees' company.
			9	The company set the incentives system that satisfies worker's needs.
			10	There is information exchange between company and current suppliers.
			11	When required, the contents of the packages printed on an external shipping label according to customer's requirements.
			12	The extent to which senior managers are oriented toward low costs and maintaining high quality when purchasing raw materials.
			13	The company tries to recognise customer's needs and execute them significantly.
			14	Your company responds to the minimum level of customer's complaints.
			15	Your company provide an excellent service to satisfy customers even if the costs increase.
			16	When applicable, sampling inspection performed in compliance with established standards (dropped).
		2.3	Informational requirements (IR)	
		Scale: [1 – not available at all and 5 – available with a high degree]		
			1	The quality system includes a documented procedure to control purchased materials and services.
			2	The initial selection of suppliers and subcontractors made in common effort with quality department.
			3	A supplier evaluation system procedure that monitors supplier performance is existed.
			4	All the purchased materials/services are subject to receiving inspection.
			5	Inspection of the incoming shipment compared to the requirements of the purchase orders and the referenced specifications.

Table 1 Measurement items (continued)

Dimensions		*Items and description of scales*	
2	Logistics management requirements (LMRs)	2.3	Informational requirements (IR)
		Scale: [1 – not available at all and 5 – available with a high degree]	
		6	Getting better quality information via the use of electronic data interchange (EDI) and decision support systems (DSS).
		7	Reducing costs via the use of just-in-time (JIT) and warehousing management system (WMS).
		8	Predicting demand at highly accurate level through the use of material requirement planning (MRP).
		9	Planning resources via the enterprise resource planning (ERP).
		10	Reducing inventory levels through the implementation of just-in-time (JIT).
		11	Using electronic data interchange (EDI) and management information systems (MIS) for enhancing the coordination among all departments.
		12	Adoption of customer relationship management (CRM) system for enhancing customer services.
		13	Applying barcode technology for improving the accuracy of information and firm's responsiveness.
		14	There is a unified system to transport the raw materials from suppliers and also transport the finished products to the distribution centres (dropped).
3	Logistic management practices (LMPs)	Scale: [1 – not available at all and 5 – available with a high degree]	
		1	Purchase orders provide an adequate description of material/service required.
		2	Procurement is made only from approved suppliers/subcontractors.
		3	There are a lot of supplying sources to select the appropriate purchasing method.
		4	The initial selection of suppliers and subcontractors made in common effort with quality department.
		5	A supplier evaluation system procedure that monitors supplier performance is existed.
		6	All the purchased materials/services are subject to receiving inspection.
		7	Inspection of the incoming shipment compared to the requirements of the purchase orders and the referenced specifications.
		8	Receiving recorders show accepted/rejected quantities.
		9	Controls and processes are adequate to prevent entry of uninspected materials into stock or manufacturing.
		10	Materials are accepted based on either certification or test reports checked against requirements and records of the check are kept.
		11	Samples checked periodically to verify conformance with specification requirements.
		12	Materials in a secure area with limited access to prevent unauthorised withdrawals.

Table 1 Measurement items (continued)

Dimensions			*Items and description of scales*
3	Logistic management practices (LMPs)	Scale: [1 – not available at all and 5 – available with a high degree]	
		13	Items stored under proper environmental conditions as applicable.
		14	There is enough space for warehousing, inventory and material handling needs.
		15	The company rent appropriate stores to store materials.
		16	There are written procedures for cleaning and storing needs to keep the storage facilities clean.
		17	There is a master list of drawings and specifications.
		18	Specifications document readily available to inspection personnel.
		19	There is a system for removing and controlling obsolete, illegible document, engineering and technical data.
		20	There are in-process inspection/controls performed by quality personnel.
		21	There are in-process inspection/controls designed, planned and compatible with operations.
		22	Inspectors have easy access to all required technical and engineering data.
		23	Non-conforming materials promptly identified and segregated.
		24	Final inspections and tests performed regularly by quality personnel.
		25	Shipping documents reference all pertinent requirements according to customer’s purchase order.
		26	Products protected against transport damage by adequate preservation and packaging.
		27	There are written procedures to prevent abuse, misuse, damage or deterioration of materials (dropped).
		28	Storage facilities are separate from work areas (dropped).
4	Challenges and problems related to the implementation of logistics management (CPs)	Scale: [1 – absolutely not agree and 5 – completely agree]	
		1	You feel a desire of unadapting to any change exists at your company (dropped).
		2	There is availability of resources and capabilities in your company.
		3	There is availability of human skills with experiences in your company.
		4	There is a sufficient support from suppliers.
		5	There are a lot of hidden costs when applying recent systems.
		6	There is integration with supplier’s systems for exchanging information.
		7	There is integration between logistics management system and the existing systems at all.
		8	There is a sufficient financial support inside company to support the recent logistics system.

Accordingly, the natural logarithm of firm's operating costs (OCA)[5] is adopted as a good proxy of logistics efficiency since it measures the efficiency inversely. Such operating costs data is collected from firm's financial reports for four years from 2011 to 2014. Taking the arithmetic average of operating costs in the current study is more justifiable for Egyptian firms that had been affected by supply chain fluctuations as a result of the Arab Spring events since the first half of 2011. The use of average will typically reduce such fluctuations.

Table 2 shows the list of the selected firms, number of distributed questionnaires and number of complete/true questionnaires in addition to the response rate of each company. Out of 194 distributed questionnaires, 169 responses are obtained where the response rate ranges from 75% to 100%. Moreover, the average response rate as a usable rate within all companies is about 87%. According to Sekaran (2003), obtaining at least 30% responses can be considered acceptable to present the population.

Table 2 Response rate of distributed questionnaires

Firm	*No. of distributed questionnaires*	*No. of complete/true questionnaires*	*Response rate (%)*
El Nasr Electric and Electronic Apparatus (NEEASAE)	24	17	75
Tractors and Engineering Company (TECO)	20	16	80
El Nasr Company for Pipes Products	20	20	100
Egyptian Company for Metallic Construction (METALCO)	25	20	80
El Nasr Company Rubber Products (NARUBIN)	18	15	83
Spring & Transport Needs Manufacturing Company (YAYAT)	20	18	90
Transport & Engineering Company	20	20	100
The Egyptian Company for Pipes and Cement Products (SIEGWART)	15	15	100
El Nasr Forging Industry	20	18	90
El Nasr Company for Metals	12	10	83
Total	194	169	87

3.2 Validity and reliability assessment

To ensure the validity of the designed questionnaire, both of content and construct validity are conducted. The content validity is assessed via an extensive literature search of the questionnaire items in past related studies. Moreover, all items of the questionnaire are tested by 17 business administration professors from different Egyptian universities as an attempt to refine and optimise these items, if necessary. The construct validity is also conducted using Pearson coefficient method. In untabulated results show that the item is retained and valid when the Pearson coefficient is significant at 0.05 significance level. Accordingly, out of 90 measurements items tested for validity, only nine items are

invalid and excluded for ensuring the accuracy of the collected data. At the same time, to ensure internal consistency (reliability) of the multi-item scale for each dimension, the Cronbach alpha is assessed. Following Nunnaly (1978) and Li et al. (2009), the scale will be reliable when the Cronbach alpha is higher than the recommended minimum standard of 0.60. As presented in Table 3, all six dimensions related to logistics management are reliable since the Cronbach alpha values are above 0.65.

Table 3 Cronbach alpha reliability analysis

Dimensions	*No. of items*	*Cronbach's alpha*
The extent to which logistics management concept is realised (ELM)	12	0.6565
Organisational requirements (OR)	8	0.691
Human resource requirements (HRR)	15	0.6995
Informational requirements (IR)	13	0.80
Logistics management practices (LMPs)	26	0.8009
Challenges and problems related to the implementation of logistics management (CP)	7	0.6799

4 Data analysis, testing hypotheses and results

4.1 Analysing data

Table 4 presents the descriptive statistics for key variables related to LMRs, practices and the logistics performance efficiency.

The mean of the operating costs average as a proxy of the logistics efficiency is about 12.918 with a range of 8.779 to 18.129. This implies that there is a moderate variation in the operating costs average among the Egyptian firms. Regarding the availability of the LMRs within the selected firms, the average of these requirements, i.e., organisational, human resource and IR are 4.493, 4.267 and 4.062, respectively. This implies that the LMRs are highly available in our dataset. At the same time, the IR have higher variation, (i.e., SD = 0.501) compared to other LMRs. Regarding LMPs, the mean value of these practices is 4.409 indicating high level of availability within Egyptian firms. Moreover, there is a little variation among firms' LMPs as it ranges between 3.711 and 4.821 with a standard deviation of 0.306.

Table 4 Descriptive summary statistics

Variables	*Mean*	*Std. dev.*	*Minimum*	*Maximum*
Operating costs average (OCA)	12.918	3.202	8.779	18.129
Organisational requirements (OR)	4.493	0.372	3.252	4.884
Human resource requirements (HRR)	4.267	0.377	3.444	4.887
Informational requirements (IR)	4.062	0.501	2.791	4.712
Logistics management practices (LMPs)	4.409	0.306	3.711	4.821

4.2 Testing hypotheses and results

4.2.1 Empirical results of testing the first hypothesis (H_1)

To accept or reject the first hypothesis, Table 5 discloses the mean, variance and directions of managers' awareness regarding logistics management concept. The overall average of managers' perceptions related to logistics management concept is found to be 4.075 and it varies between 1.20 and 4.67. This implies that managers are aware of such concept and various activities and processes of providing materials requirements. However, the mean value of managers' awareness regarding the combining of purchasing, storage, distribution and quality control activities in a separate department known as logistics management department is 1.20. This average is lower than other items under investigation. At the same time, the overall variance value of all elements related to the perception of logistics management concept is 0.165, ranging from 0.035 to 0.27. This implies that there is a variation in the perception of logistics management concept among all managers within the selected firms as hypothesised. Therefore, H_1 is supported.

Regarding managers' perception of logistics management concept across the selected firms, Table 6 also reports that the overall mean of the perception for the selected firms is 3.73. It ranges between 2.76 and 4.12. Out of ten firms, the mean of such awareness within five firms is less than the overall average. In addition, to investigate the significant variation among managers regarding the awareness of logistics management concept, Kruskal-Wallis test is deployed. The χ^2 statistic is found to be statistically significant at the 0.01 level of significance. Overall, such empirical findings support the contention that there is significant variation in managers' perception of logistics management concept.

4.2.2 Empirical results of testing the second hypothesis (H_2)

Table 7 illustrates the Kruskal-Wallis test for investigating the significant differences among the selected firms according to the availability degree of LMRs. The χ^2 statistic of organisational, informational and HRR are 97.92, 143.35 and 142.52, respectively. The aforementioned results are found to be statistically significant at the 0.01 level of significance and thus H_2 is accepted. The possible reason for the significant variations among the three requirements may be due to the variations related to LMPs across all selected companies.

Table 8 summaries the average of LMPs and the Kruskal-Wallis test for investigating the significant variations of LMPs among all selected companies. The means of LMPs within NEEASAE, El Nasr Company for Pipes Products, METALCO, YAYAT and SIEGWART are above the overall average with values of 4.47, 4.76, 4.74, 4.59 and 4.42, respectively. At the same time, the means of other firms (e.g., TECO, NARUBIN, Transport & Engineering Company, El Nasr Forging Industry and El Nasr Company for Metals) are less than the overall average with values of 4.21, 4.20, 4.27, 4.23 and 3.67, respectively. These results imply that there are variations and differences among companies in practicing logistics management activities.

Table 5 Managers' perceptions of logistics management concept

	Items related to awareness of logistics management concept	*Mean*	*Variance*	*Direction*
1	Senior managers keen to select and appoint a high efficient personnel responsible for logistics activities.	4.67	0.108	Available with a high degree
2	The extent to which senior managers are oriented toward low cost while maintaining high quality.	4.57	0.14	Available with a high degree
3	Your company combine the activities of purchasing, storage, distribution and quality control in a separate department called logistics management department.	1.20	0.035	Not Available at all
4	Workers in your company adapt to any change happens inside it.	4.14	0.19	Available moderately
5	Senior managers are interested in directing workers toward change and training them to solve problem.	4.35	0.157	Available with a high degree
6	Senior managers put in top priorities improving their relationships with suppliers.	4.41	0.214	Available with a high degree
7	Senior managers put in top priorities the participation of all departments in decision making.	4.24	0.22	Available with a high degree
8	The quality system includes documented purchasing system.	4.64	0.138	Available with a high degree
9	Senior managers put in their priorities achieving coordination and integration among all departments in organisation.	4.49	0.173	Available with a high degree
10	There is a system in place to adequately control the handling storage and packaging of products.	4.17	0.23	Available moderately
11	Senior managers permit employees' participation in putting plans and programs for their jobs.	4.01	0.27	Available moderately
12	Workers are empowered to take decisions on their jobs.	4.02	0.105	Available moderately
Overall average		*4.075*		
Overall variance			*0.165*	

Table 6 Kruskal-Wallis rank test for managers' awareness of logistics management concept across the selected firms

Firm	*Mean*	χ^2
El Nasr Electric and Electronic Apparatus (NEEASAE)	4.11	137.042***
Tractors and Engineering Company (TECO)	3.71	
El Nasr Company for Pipes Products	4.12	
Egyptian Company for Metallic Construction (METALCO)	3.81	
El Nasr Company Rubber Products (NARUBIN)	3.47	
Spring & Transport Needs Manufacturing Company (YAYAT)	3.97	
Transport & Engineering Company	3.41	
The Egyptian Company for Pipes and Cement Products (SIEGWART)	3.50	
El Nasr Forging Industry	4	
El Nasr company for Metals	2.76	
Overall average	*3.73*	

Note: ***Indicates significant at 0.01 significance level.

Table 7 Kruskal-Wallis rank test of the LMRs

Logistics management requirements	χ^2
Organisational requirements (OR)	97.92***
Human resource requirements (HRR)	142.52***
Informational requirements (IR)	143.35***

Note: ***Indicates significant at 0.01 significance level.

Table 8 Kruskal-Wallis rank test of LMPs across the selected firms

Firm	*Mean*	χ^2
El Nasr Electric and Electronic Apparatus (NEEASAE)	4.47	133.296***
Tractors and Engineering Company (TECO)	4.21	
El Nasr Company for Pipes Products	4.76	
Egyptian Company for Metallic Construction (METALCO)	4.74	
El Nasr Company Rubber Products (NARUBIN)	4.20	
Spring & Transport Needs Manufacturing Company (YAYAT)	4.59	
Transport & Engineering Company	4.27	
The Egyptian Company for Pipes and Cement Products (SIEGWART)	4.42	
El Nasr Forging Industry	4.23	
El Nasr Company for Metals	3.76	
Overall average	*4.40*	

Note: ***Indicates significant at 0.01 significance level.

4.2.3 Empirical results of testing the third hypothesis (H_3)

To test whether there is significant association between logistics performance efficiency and both of LMRs and practices using a sample of companies within the Egyptian

engineering industries, the following regression model is designed and can be defined by equation (1) as follows:

$$OCA_i = \beta_0 + \beta_1(OR)_i + \beta_2(HRR)_i + \beta_3(IR)_i + \beta_4(LMP)_i + \varepsilon_i \quad (1)$$

where OCA_i represents the operating costs average – as measured by taking the natural logarithm of operating costs average of firm i over four-year period (2011–2014). *OR* represents the OR of logistics management for each company (i); *HRR* refers to HRR of logistics management for the i^{th} company; *IR* is the IR of logistics management; *LMP* refers to *LMPs*; β_0 is constant; β_i are the regression coefficients of independent variables and ε_i is the error term.

To estimate the coefficients of a regression model defined in equation (1), the main assumptions of ordinary least square (OLS), i.e., multi-collinearity, normality, heteroscedasticity and existence of outliers are firstly tested. Regarding the existence of multi-collinearity problem among the predictors' variables, the Pearson correlation matrix is estimated as shown in Table 9.

Table 9 Correlation matrix

Variables	*OCA*	*OR*	*HRR*	*IR*	*LMP*
OCA	1				
OR	–0.1462*	1			
HRR	0.2653***	0.3636***	1		
IR	–0.0250	0.5153***	0.2872***	1	
LMP	–0.1539**	0.6591***	0.6143***	0.6591***	1

Notes: ***Significant at 0.01 (two-tailed), **significant at 0.05 (two-tailed) and *significant at 0.10 (two-tailed).
OCA is the operating costs average as a proxy of the performance logistics efficiency. OR is the organisational requirements of logistics management, HRR represents the human resource requirements, IR refers to informational requirements of logistics management and LMP is the logistics management practices.

Table 10 Tests for the OLS assumptions

Tests	*OCA*
Variance inflation factor (VIF)	< 4
Shapiro-Wilk W test	0.8118***
Shapiro-Francia W test	0.8107***
Jarque-Bera (skewness/kurtosis test)	53.15***
Cameron and Trivedi's decomposition of IM test	136.20***
Cook-Weisberg test	276.11**
Interquartile range test (IQR)	Yes**
No. of observations	169

Notes: ***Significant at 0.01 (two-tailed) and **significant at 0.05 (two-tailed).

Following Gujarati (1995), Anderson et al. (1990) and Bryman and Cramer (1997), any correlation coefficient less than 0.7 level reveals the absence of serious multi-collinearity problem. Accordingly, the possibility of finding such problem among the proposed

explanatory variables is not existed as all of the correlation coefficients are less than 0.7. In addition, a variance inflation factor (VIF) is used as indicator of multi-collinearity problem. As shown in Table 10, the VIF values for the independent variables are below the cut-off value of 5. Following Rogerson (2001) and Caramanis and Spathis (2006), this can be another indication of nonexistence of serious multi-collinearity problem in our analysis.

Additionally, the correlation coefficients shown in Table 9 illustrate significant negative correlations between operating costs average and both of LMPs and OR at 5% and 10% significance levels, respectively. There is also a significant positive correlation between operating cost average (OCA) and HRR at 1% significance level. However, no significant correlation has been found between OCA and IR.

Table 10 discloses the results of testing the OLS assumptions. Shapiro-Wilk W test, Shapiro-Francia W test and Jarque-Bera test are deployed to test the normality assumption of the residuals. The results are significant at 0.01 level implying that the residuals are non-normally distributed. At the same time, interquartile range test (IQR) is deployed to test the existence of severe outliers. Ten severe outliers are statistically significant at a 5% significance level implying that the distribution is not fairly symmetric and the residuals have not normal distribution. Both of the Cameron and Trivedi's decomposition of IM test and Cook-Weisberg test are used to detect the heteroscedasticity within the residuals. The significant results at a 10% level indicate the existence of heteroscedasticity.

Due to the violation of the OLS assumptions, i.e., the normality and homoscedasticity of the residuals, the least absolute value (LAV) regression can be a robust alternative. The LAV regression as a semi-parametric model avoids the assumptions about the parametric distribution of the error term. Moreover, the previous literature (e.g., Shahwan, 2015; Elsayed, 2007) indicates that the LAV provides better estimates than the OLS on the existence of outliers. Table 11 summarises the results of the LAV regression. These results indicate that there is no significant association between the availability of OR related to logistics management and the firm's OCA as a proxy of logistics management efficiency. A possible explanation is that OR, i.e., developing organisational chart, improving decision making process and changing organisational culture have a little effect on operating costs. However, the other two dimensions of LMRs, i.e., human resource and IR were found to be statistically significant at the 5% and 1% level, respectively. A plausible explanation of such positive impact, on the one hand, is that reaching a desirable level of the HRR and IR (e.g., entry of recent updated information systems, training managers and employees, motivating employees, investing in substantial R&D activities) is by nature costly. On the other hand, all companies under investigation do not have a separate department called logistics management. Different logistics activities are distributed upon other departments. Such fragmentation of the logistics activities results in severe conflicts which increase the firm's OCA, reduces the efficiency of a logistics operating system and minimises the efficiency of the firm as a whole.

As hypothesised, there is a negative association between the LMPs and the OCA at 1% level of significance. This finding is in line with the findings of Liu, (2011), Mohan (2013) and Erkan (2014) that LMPs enhance the logistics performance efficiency. Pseudo R^2 for the fitted model equals 0.225. This implies that about 23% of the variance in the

operating costs average can be explained by our model. According to Ralston et al. (2013) and Mohan (2013), this achieved percentage of pseudo R^2 has been considered scientifically accepted. Moreover, Louviere et al. (2000) stated that a value of rho-squared ranging between 0.20 and 0.40 is an indication of extremely good model fits.

Table 11 LMRs and practices on logistics performance efficiency: LAV regression results

Explanatory variables	*OCA*
Constant	19.616
	(3.64)
OR	0.0551
	(0.05)
HRR	2.243
	(2.29)**
IR	7.583***
	(5.93)
LMP	–10.752***
	(–4.63)
Pseudo R^2 (%)	22.5%
N	169

Note: The values in parentheses are t-value and ** denotes 5% level of significance and *** denotes 1% level of significance.

Overall, the empirical findings partially support the third hypothesis that there is a significant effect of the availability of LMRs and practices on logistics performance efficiency.

4.2.4 Empirical results of testing the fourth hypothesis (H_4)

Our second model is built to investigate whether there is a significant positive relationship between LMRs and LMPs. The following regression model as defined by equation (2) is deployed, where we regress the estimate of LMP on the LMRs of firm *i*. This model will be used to measure and test H_4.

$$LMP_i = \beta_0 + \beta_1(OR)_i + \beta_2(HRR)_i + \beta_3(IR)_i + \varepsilon_i \quad (2)$$

where all variables are previously defined in equation (1).

Table 12 reports the results obtained from the LAV regression of model 2. The results indicate that there is a significant positive impact of logistics requirements, i.e., OR, IR and HRR on LMPs at 0.01 level of significance. In addition, the LMRs are found to explain about 49.3% of the total variance in the LMPs. Such a positive association implies that increasing the availability of OR, IR and HRR would enhance the LMPs as a mean of achieving competitive advantage. This is consistent with literature where firms with low levels of LMRs are most likely to be less effective in building logistics and supply chain capabilities (Okeudo, 2012). In general, this significant positive relationship leads us to accept the fourth hypothesis H_4 of this paper.

Table 12 LMRs on LMPs: LAV regression results

Explanatory variables	*LMP*
Constant	0.7719***
	(8.62)
OR	0.3252***
	(17.28)
HRR	0.2898
	(17.42)***
IR	0.2255***
	(16.48)
Pseudo R^2 (%)	49.35%
N	169

Note: The values in parentheses are t-value and *** denotes 1% level of significance.

4.2.5 Empirical results of testing the fifth hypothesis (H_5)

We should note that the third hypothesis partially asserted the positive association between logistics performance efficiency and LMRs; but there is a negative association with LMP. At the same time, the fourth hypothesis supported the positive association between LMRs and LMPs. This implies that the association between LMRs and logistics performance efficiency may be indirect rather than a direct main effect. Accordingly, LMPs may mediate the relationship between LMRs as independent variables and logistics performance efficiency as dependent variable.

To investigate such mediation assumption, three conditions proposed by Baron and Kenny (1986) and Li et al. (2009) should be met. These conditions include:

1 A significant relationship between the independent and the mediator variables.

2 The independent variables have significant relationships with the dependent variable in the absence of the mediator

3 The relationship between the dependent and independent variables will be attenuated by the inclusion of the mediator while showing a significant relationship between the mediator and the dependent variable.

Table 13, panel A shows the standardised path coefficients of testing the aforementioned conditions using structural equation modelling. The results reveal that the LMRs, i.e., OR, IR and HRR as independent variables have significantly positive association with LMPs as a mediator variable at 0.01 level of significance. Thus, the first condition of mediation is met. Then, two of LMRs, IR and HRR, as independent variables have significantly positive association with logistics performance efficiency at 0.01 level of significance while the OR is not significant. This partially supports the second condition of the mediation assumption. By inclusion the LMPs as a mediator variable, we find that LMP has a negative significant relationship with logistics performance efficiency at 0.01 level of significance. This supports the third condition of the mediation assumption. Overall, the availability of the above mentioned conditions confirms the mediating effect of LMPs.

Table 13 The estimates of structural equation modelling

Panel A: standardised path coefficients					
Mediation's conditions		*Path*	*Coefficient*	*Z*	*Confirmed*
1	The independent variables vs. the mediating variable	OR and LMP	0.3625	7.72***	Yes
		IR and LMP	0.3638	7.99***	Yes
		HRR and LMP	0.3781	9.15***	Yes
2	The independent variable vs. the dependent variable (without the mediator)	OR and OCA	–0.0388	–0.43	No
		IR and OCA	0.2695	3.09***	Yes
		HRR and OCA	0.6253	8.81***	Yes
3	The mediator variable vs. the dependent variable	LMP and OCA	–0.6889	–5.91***	Yes
Panel B: direct, indirect and total effects of mediation					
Relationship		*Direct effect*	*Indirect effect*	*Total effect*	*Type of mediation*
OR and OCA		–0.3317ns	–2.1513***	–2.4860***	Full
IR and OCA		1.7241***	–1.6031***	0.1210ns	Partial
HRR and OCA		5.3061***	–2.2103***	3.0958***	Partial
Panel C: goodness-of-fit indices					
RMSEA		0.000			
CFI		1			
TLI		1			
SRMR		0.000			
CD		0.792			

Note: ***Indicates significant at 0.01 level and ns refers to no significant.

Additionally, Table 13, panel B indicates the direct, indirect and total effects of mediation. The results demonstrate that LMPs fully mediate the relationship between OR and logistics performance efficiency (total effect = –2.4860, $p < 0.001$, indirect effect = –2.1513, $p < 0.000$, direct effect = –0.3347, $p > 0.10$). However, the LMPs has a partial mediation on the association between IR and logistics performance efficiency (total effect = 0.1210, $p > 0.10$, indirect effect = –1.6031, $p < 0.001$, direct effect = 1.7241, $p < 0.003$). In addition, LMPs partially mediate the association between HRR and logistics performance efficiency (total effect = 3.0958, $p < 0.001$, indirect effect = –2.2103, $p < 0.001$, direct effect = 5.3061, $p < .001$). Table 12, panel C illustrates various goodness-of-fit indices where (RMSEA = 0.000, CFI = 1, TLI = 1, SRMR = 0.000 and CD = 0.792) indicate a very good fit. Accordingly, the results support H_5 that LMPs mediates the relationship between logistics requirements and logistics efficiency.

5 Conclusions and implications

This study develops a conceptual model to investigate managers' perception of logistics management concept, the availability of LMRs, practices and their impact on logistics performance efficiency. In addition, the study examines the mediating role of LMPs in

the association between LMRs and logistics performance efficiency. Our dataset is collected based on a survey questionnaire directed to 169 managers within ten public firms related to Egyptian engineering industries field. The findings of this study contribute to theoretical development of logistics performance within Egyptian environment in several ways as follows:

a Our results show that the selected Egyptian firms as a whole do not have a separate department called logistics management. All logistics activities are distributed upon other departments where different LMRs and practices are not organised in an integrated system. However, the overall average of managers' perception of logistics management concept is relatively high within the selected firms. The variations in such managers' perception across the selected firms are statistically significant. This implies that there is a need to develop an integrated framework for logistics management system within Egyptian firms.

b Our findings reveal significant differences regarding the availability degree of LMRs and practices across the targeted firms. Such significant variations may be due to the significant variations in manager's awareness of logistics management concept. These findings clearly show the need to exert additional efforts for enhancing the awareness of Egyptian managers not only for the logistics management concept but also for its requirements and practices.

c The results disclose no significant relationship between logistics performance efficiency and OR. At the same time, both of human resource and IR significantly affect the logistics performance efficiency. Such results shed light on the most critical factors associated with logistics performance efficiency. From a practical point of view, senior managers in an emerging economy like Egypt should be aware of the following IR [e.g., MRP system (MRPI, MRPII); ERP system; warehousing management system (WMS); customer relationship management (CRM) system; supplier relationship management (SRM) system; just-in-time (JIT) system; e-commerce; e-business; decision support system (DSS); electronic data interchange (EDI) system; and bar coding system] for increasing IR effects on logistics management efficiency. Substantial efforts involving training employees on modern techniques related to logistics management, tighten controlling standards related to quality and distribution and enhancing the availability of HRR would consequently enhance the firm's logistics performance efficiency.

d Finally, this study reveals the mediator role of LMPs in the relationship between LMRs and logistics performance efficiency. These findings would support our understanding of how LMRs affect logistics performance efficiency and also illustrate the role that LMPs play in this relationship.

This study has some inherent limitations. First, the study is based on dataset only collected from firms related to Egyptian engineering industries where the population and sample size are relatively small. To generalise our findings, future studies are encouraged to investigate the aforementioned associations among the dependent, mediator and independent variables using data derived from other Egyptian industrial or service sectors. Second, the current study is only restricted to logistics performance efficiency as measured by taking the natural logarithm of operating costs average. Future studies might expand the scope of the study by using different financial and nonfinancial measures of

firm logistics performance. Third, this study examines the relationship between LMRs and logistics performance efficiency by adding LMPs as a mediator. Future studies are strongly recommended to explore the impact of other potential mediators such as organisational culture and the change of manager on such relationship. Moreover, this study tests the research hypotheses using cross-sectional data. We recommend future studies to adopt longitudinal approach over longer period of time for testing and examining these hypotheses.

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Notes

1 LMRs involve organisational, human resource and IR that are vital for enhancing logistics practices and logistics efficiency. The OR of logistics management are mainly concerned with four sub-dimensions:

   a redesigning and developing organisational structure

   b developing decision making process

   c continuous improvement and orientation toward change

   d full organisational integration among all activities and functions within the firm.

   Regarding the HRR, these requirements involve support and commitment of top management for qualifying the human resource, developing an effective compensation system for enhancing the loyalty of employees, supporting employees' participation in decision making process and enhancing the integration between HR practices and logistics management activities. In the context of IR of logistics management, different information systems [e.g., MRP system; ERP system; WMS; CRM system; SRM system; JIT system; e-commerce; DSS; EDI system; bar coding system] are required for enhancing the integration between logistics processes and other organisational processes.

2 LMPs refer to numerous practices related to logistics activities (e.g., purchasing system; materials planning system; inventory, packaging and handling materials systems; transportation systems; and quality control system).

3 Logistics efficiency is one of the important dimensions of logistics performance metrics as it does not only affect the internal process of a business unit but also influences customer satisfaction. In general, logistics efficiency refers to how effectively a business unit reduces logistics costs, improving quality of service levels and holding reliable and sustainable distribution in order to achieve competitiveness. In the current study, we focus on cost cutting as an approach for enhancing logistics efficiency rather than service enhancement 'quality improvement'. The adoption of such approach is more relevant to an emerging market like Egypt due to the limitation of both resources and management capabilities.

4 The World Bank LPI as a composite country ranking consists of six sub scores: customs, infrastructure, international shipments, logistics competence, tracking and tracing and timelineless.

5 Natural logarithm of firm operating cost is being used as a proxy, instead of simply the operating cost because of the large size of this variable compared to other variables. One of the problems in regression analysis is the existence of gross size variables which leads to very large R^2 values, but prove nothing. One of the solutions is to take the natural logarithm of such gross size variable.