

# **Survey of logistics performance and adoption of logistics technology in Omani companies**

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## ABSTRACT

A mailed questionnaire was used to collect data from Omani companies regarding their current logistics practices. The questionnaire covers several segments of logistics such as logistics department, importance of logistics activities, performance measurements and logistics technology adoption. The results show that Omani industry is aware of the importance of logistics and working steadily toward an integrative approach of logistics. However, they lack the formal mechanism to guide them through a better use of logistics technology. In addition, performance measurements that are based on cost are used more than those based on customer service.

*Keywords: Logistics performance; Technology adoption; Empirical data; Oman.*

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## INTRODUCTION

Traditionally, logistics was perceived as a supportive area to an organization with production, finance/accounting, marketing, and management as key departments in any company (Sum et al, 2001). This is because the role of logistics was limited to transportation and warehousing and it was even possible for marketing and production departments to accommodate the activities of logistics. However, as businesses grew and customer base expanded, the load on marketing and production became overwhelming (Voorhees et al, 1988). This overload led to deterioration in customer service levels as a result of losing orders or late time deliveries. Also, this resulted in an inefficient management of inventory; increase in distribution costs and above all dramatic falls in profit margins (Bowersox, 1983; Langley, 1986). As a result, the logistics department emerged to take on the responsibility to manage the forward and reverse flow and storage of goods, services and related information between the point of origin and the point of consumption such that total costs are minimized and customer targets are achieved (Council of supply chain management professionals, 2006). Presently, the definition of logistics covers purchasing, distribution, inventory management, packaging, manufacturing, and even customer service (Bowersox and Closs, 1996). As the diffusion of logistics concept and practice is not similar in all countries, it is necessary to proctor the spread of it in different places. Further, this is important in order to draw lessons, refine concepts, and make recommendations.

Since 1970, Oman has been going through consistent challenges to meet the demands of a growing market. Besides, the logistics sector (composed of transportation, telecommunication, customs and warehousing) in Oman faces tremendous competition from neighbor countries. The air freight, in year 2004, accounts for only 3% of the total air freight (incoming and outgoing) in Gulf Cooperative Countries with UAE accounting for 61% of it (The Cooperation Council for the Arab States of the Gulf, 2006). Therefore, for Oman to overcome these challenges and be ahead in competition, a continuous analysis needs to be conducted for the different industries in Oman at the national and the organizational levels. A thorough search for studies pertaining to logistics industry in Oman found no published papers. Therefore, this study represents the first to investigate the Omani logistics industry at the organizational level. Specifically, this study aims to achieve the following:

- Understand and classify the logistics practices (e.g. existence of logistics at the strategic level, performance measurements and outsourcing) of Omani organizations.
- Identify the level of implementation of various logistics technologies.
- Identify strategies that Omani organizations can use to increase their presence in a global market.

## **LITERATURE REVIEW**

Logistics has evolved, over time, through several stages. Langley (1986) presented four stages of advances in logistics function. In the first stage, logistics activities are viewed as an area for cost control. In the second stage, companies recognize that logistics capabilities can have a positive impact on sales, but they are unsuccessful in precisely measuring this impact. In the third stage, companies advanced beyond the effect of logistics on sales and profits and view logistics as a key way in which they can differentiate their products and service offerings from competitors. Further, companies in this stage can use this differentiation as a key input in strategy formulation in the area of market segmentation. In the fourth stage, companies use logistics as a principal strategic advantage.

On the other hand, Bowersox and Daugherty (1995) explain the development of logistics in organizations along a continuum from a fragmented to an integrated to a strategic orientation. Initially, logistics operations are fragmented, but managers realize that logistics can make significant contributions to overall performance. However, it is difficult for these managers to gain widespread support throughout their organization for establishing integrated operations. Organizations at this level work on evaluation and integration of separate groupings for the objective of reducing operating costs. As these firms begin to realize the increase in efficiency from these integrated groupings, they seek greater integration of the value-added processes. Therefore, modifications in operational and organizational structure begin to be

guided by asset utilization. Further, customer service becomes the driver for service offering for these organizations. Through high quality customer service, some firms seek to gain competitive advantage by being highly responsive, which is an important step toward positioning to use logistics strategically. Beyond this point, firms aggressively seek to exploit logistics competencies as a way to gain and maintain a competitive advantage. At this level, value-added services become strategic resources, tailored by customers to gain loyalty. Further, long-term supplier and customer relationships along with strategic alliances become common where the objective is to maintain the competitive advantage. The authors added that technology adoption and receptivity of management to change can accelerate the speed at which those firms progress to strategic orientation.

Christopher (1993) explored the area where firms use logistics as a driver for customer service and as a competitive advantage to differentiate themselves from competitors. He proposed that superior customer service builds relationships with customers which in turn lead to improved rates of customer retention, where this last element has an impact on profitability. Further, he highlighted that logistics is the process that delivers customer service which is translated as the satisfaction through the provision of time and place utility. Also, he pointed that the kind of logistics system that achieves the above is service-driven in nature which requires the firm to transform by developing the appropriate logistics strategies and structures. In order to develop these logistics strategies, a firm needs to identify customer service requirements by the means of research (e.g. customer surveys and interviews) and competitive benchmarking. Also, the firm needs to streamline the ordering process by eliminating the non-value-added activities. O'Neil and Iveson (1991) elaborated on this matter by developing a model for strategic management of logistics functions. In their model, logistics strategy is developed from customer strategy.

The above two papers considered customer service as the basis for developing logistics strategy. Bowersox and Daugherty (1987) gave another two logistics strategies which are based on factors or orientations other than customer service. The first one is process strategy. In this strategy, materials and components represent high cost in the overall value added process and the primary objective is to gain control over activities that increase the cost in the flow. The other one is the information strategy and it is more concerned with boundary spanning and places high priority on external control. Firms in this category are engaged in extensive dealer/distribution networks and there is a tremendous need for inter-organizational coordination and use of logistics to achieve cooperation and collaboration.

Logistics technology was found to be related to the integration of the organization. Germain et al (1994) found that software logistics technologies like material requirement planning, electronic data

interchange and distribution requirement planning which require the implementation of more than one department are significantly related to senior level integration, while those that are implemented within a single organization function such as software in inventory control, warehousing and transportation are not related to senior level integration. Bowersox and Droge (1989) found that leading edge firms have more logistics technology applications than the norm firms. Logistics technology was also found to be significantly related to logistics department, performance measurement, and logistics strategy (Dawe, 1994). Organizations using complex performance evaluation and those with a department called logistics are currently and planning to use more logistics technology than other organizations. Also, those companies that are using more aggressive logistics strategies are planning to use more technologies than those companies with less aggressive strategies.

Studies which investigated the development and maturity of logistics at the organizational level used varying approaches. In Bowersox et al (1989), a common attributes index (CAI) was used to classify companies according to their strategic logistics orientation. The CAI was computed from variables such as the existence of a formal logistics mission statement and the position of the most senior logistics executive in the companies. Based on the aggregate score of each company, companies were classified into leading edge, norm and emerging. Companies with CAI score greater than one positive standard deviation of the mean were classified as leading, and companies within one standard deviation of the mean were classified as norm. Companies in the lower tail of the normal distribution were classified as emerging.

In a quite similar way, Sum et al (2001) developed Strategic Index (SI) to classify companies in Singapore into strategic, supportive, and neutral. The SI score used five strategic areas of logistics to classify the companies namely, existence of centralized/coordinated logistics department, existence of a formal logistics mission statement, existence of a formal logistics plan, extent of participation of logistics executive in strategic planning and alignment of the logistics objectives with overall business objectives. Kim (1996) used a difference approach to investigate the development of logistics in Korean companies. The author attempted not to classify the companies, but rather tested various areas of logistics separately and compared the results to other studies in literature. Some of the areas investigated by Kim are formalization of logistics activities, innovativeness, responsiveness, technology adoption and use.

## **METHODOLOGY**

A questionnaire survey was adopted as the key methodology for this study. The choice of this methodology is best supported by its use in the above studies of logistics and it provides a wide coverage

over several organizations. The survey questions and elements were gathered from other studies in logistics (Kim, 1996 and Patterson et al, 2003) as well as some books (Ballou, 1999; Heizer and Render, 2001)

A mailed questionnaire was used to collect data from Omani companies. The questionnaire was pre-tested in order to remove any ambiguity or misunderstanding of some questions. The survey was then sent to 400 companies selected from trade directory of Oman Chamber of Commerce and Industry (2004). A total of 50 surveys was received representing a 12.5 per cent response rate. The achieved response rate is considered reasonable when compared to other similar logistics studies (15.3 per cent by Sum et al, 2001; 12.8 per cent by Mentzer et al (1992); 13.4 per cent by Anderson (1984) and 15 per cent by Murphy and Daley (1994)). However, we shouldn't diverge from the fact that rigorous statistical testing may not be possible given this response rate. As a result, the main statistical method of analysis which will be used is descriptive statistics (Tabular and graphical) along with non-parametric methods. In order to investigate the reason for this low response rate, the authors contacted some of the non-respondents. The main reason was reported as due to lack of confidentiality.

## **FINDINGS AND DISCUSSIONS**

The respondents consist of General Managers (19.3%), Senior Executives (6.5%) and Managers (74.2%). The annual sales mean of the responding companies is 33 million AUD, with a median of 2.6 million AUD, and a standard deviation of 26.6 million AUD. The median is less than the mean which indicates that most respondents have a high annual sales volume, while the standard deviation indicates that there is a big difference among the different companies. Since the sample size is not large enough, there will be no point in separating the companies according to their revenues.

The organizational characteristics section of the survey provided some additional insights into the Omani Companies. About 81% of the companies have a total number of employees of 500 or less and 74% of the companies had a stable demand behavior. Moreover, almost 50% of Omani companies have worldwide distribution channels which necessitate forming a logistics department in the company. Table 1 suggests that logistics users from a variety of industrial sectors are represented, with the majority of the companies coming from the chemicals and food & beverages sectors.

| Industry           | Percent |
|--------------------|---------|
| Automotive         | 6.5     |
| Chemicals          | 19.4    |
| Food and Beverages | 16.1    |
| Footwear           | 3.2     |
| Metals             | 12.9    |
| Petroleum Products | 16      |
| Shipping           | 6.5     |
| Telecomm           | 12.9    |
| Other              | 6.5     |
| Total              | 100     |

**Table 1.**  
**Respondents by**  
**industry group**

### *Classification of companies*

Kearney (1984: 47) stated that “virtually no company falls completely and exclusively into one stage of sophistication. Individual divisions often fall into different categories”. In addition, breadth of questionnaire surveys used in logistics classification studies is vast and very detailed. Therefore, a precise classification of Omani companies won’t be possible given the number of questions asked in this survey and the response rate. However, use of non-parametric studies with support from descriptive statistics should give a tentative measure for classification of logistics within Omani companies.

### *Organizational logistics infrastructure (performance)*

**Logistics department and strategic level of logistics:** Respondents were asked if they have a separate logistics department in their organizations and 58 % of them answered yes. After testing if it is above 50% for the whole population using nonparametric Binomial Distribution, the proportion wasn't statistically significant at the 5% significance level ( $p\text{-value} = .472$ ). The strategic level of logistics in Omani organizations was examined using three questions. First, respondents were asked to rate the extent their organization has a clearly stated and comprehensive logistics management strategy (1 = not at all, 5 = to a great extent). Secondly, they were asked to what extent logistics management planning is well coordinated with the overall strategic planning process using the same five-point scale. Finally, question was asked to what extent logistics cost management is being implemented. Consecutively, the mean scores are 3.8, 3.87 and 3.94. Tentatively speaking, the logistics department result and the strategic level analysis show that the level of logistics within Omani companies is in the mediocre or norm level. However, the results show that the companies do value the existence of logistics. Further analysis should give more explanation.

**Importance of logistics activities:** A list of logistics activities (Ballou, 1999) was exposed to the respondents who were asked to evaluate the importance of each activity to their organization. The results of the process are summarized in table 2.

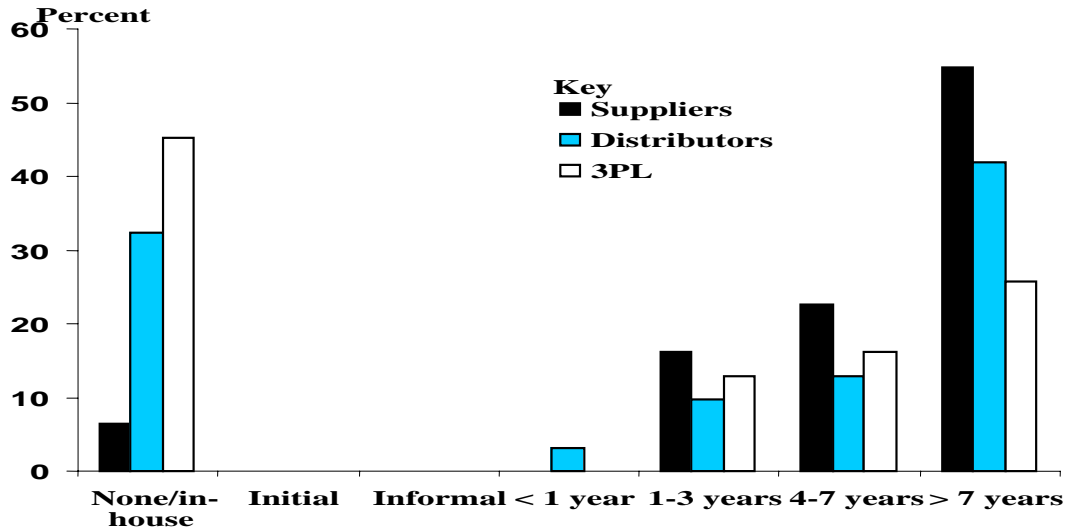
|                       | Mean   | Rank |                           | Mean   | Rank |  |
|-----------------------|--------|------|---------------------------|--------|------|--|
| Customer Service      | 4.7    | 1    | Material Handling         | 3.8    | 7    |  |
| Inventory Control     | 4.6129 | 2    | Site Location             | 3.4839 | 8    |  |
| Warehousing & Storage | 4.3871 | 3    | Packaging                 | 3.4667 | 9    |  |
| Procurement           | 4.3548 | 4    | Production Planning       | 3.3667 | 10   |  |
| Order processing      | 4.3548 | 5    | Parts and Service Support | 3.3548 | 11   |  |
| Demand Forecasting    | 3.8333 | 6    | Reverse Logistics         | 2.4333 | 12   |  |

**Table.2**  
**Relative importance of logistics activities**

For Omani companies, the first six most important activities of logistics are customer service, inventory control, warehousing, procurement, and order processing (mean score of 4 or more). The second group consists of two activities: demand forecasting and material handling (mean score of 3.8). The third group consists of site location, packaging, production planning, parts and service support with a mean score of 3.4. It is surprising to see that packaging and production planning are ranked relatively low. This indicates that Omani companies should strive toward more use of those two activities. The low rank of site location indicates the localized look of the respondents where most companies have a single site which is mainly located in the capital. After WTO accession and the implementation of the Unified Customs Law for GCC countries, it is expected that Omani companies will turn their minds more toward the outside world. Parts and service support activity is perceived as not very important. This reveals the concern that providing service after selling the product is minimal within Omani companies. The last group consists of one activity which is reverse logistics with a mean score of 2.4. This clearly shows that there is almost no reverse channel for logistics in Oman and that this term is relatively new to them. It is to some extent that several companies didn't know what it means.

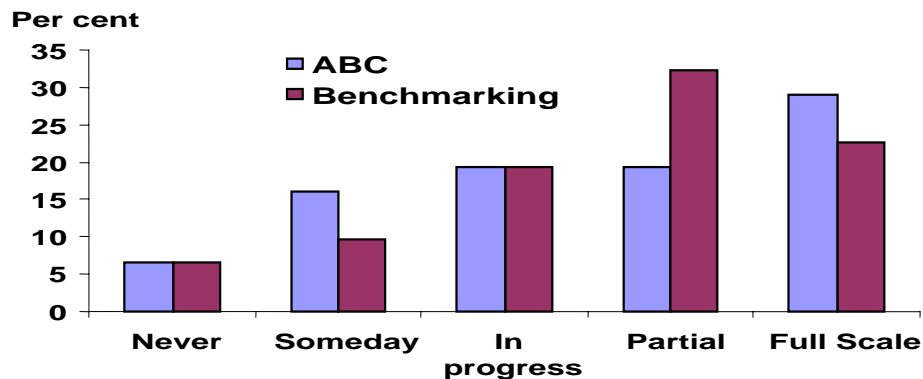
**Partnerships:** The extent of partnership with third party logistics has been moderate (mean score = 3.87 on a seven point scale), but Omani companies are in transferring to use greater services provided by 3PL to perform logistics operations (see figure 1). The percentages of respondents who have more than one year formal relationship with suppliers and service providers are 93.5 per cent and 55 per cent respectively. Comparably, the percentages for Korean companies are 22 per cent and 17.5 per cent and for US and Canadian firms, they are 33 per cent (Bowersox, et al, 1989, Byrne, 1993 and Kim, 1996).





**Figure 1.**  
**Partnerships**

**Activity based costing (ABC) and benchmarking:** Because of their relevance to logistics, it was important to ask companies about the implementation levels of those techniques (See figure 2). As for Activity Based Costing, 19.4 per cent are implementing it on a partial basis and 29 per cent were using it in a full-scale basis. Kim (1998) found that only 6 per cent of the Korean companies are implementing ABC in a full-scale basis.

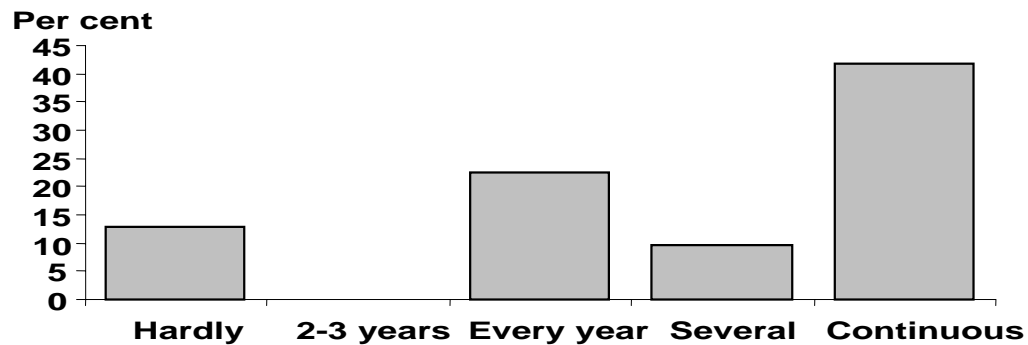


**Figure 2.**  
**Implementation level of ABC and Benchmarking**

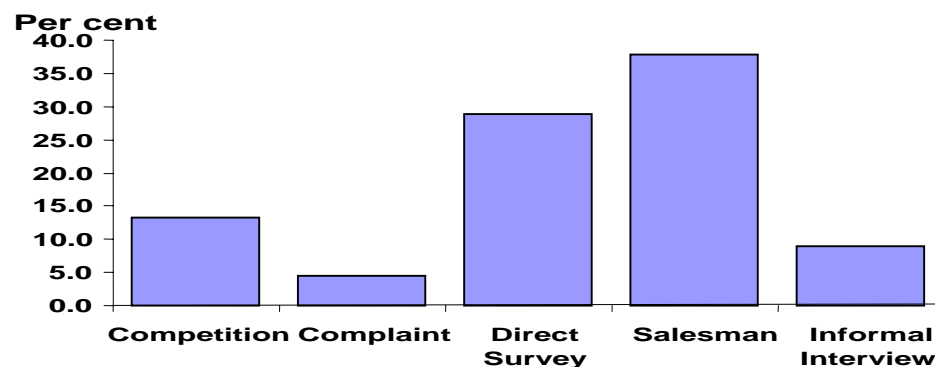
As for Benchmarking, 32.3 per cent are partially implementing it, and 22.6 per cent are implementing it on a full-scale basis. According to Bowersox et al (1989), 59.58 per cent of US firms are using benchmarking.

**Customer service:** According to table 2, customer service was ranked as the most important logistics activity. As a result, two questions were further exposed to survey participants with regard to frequency of customer requirements studies and the methods used to identify them. Figure 3 shows that

approximately 74 per cent of respondents conduct at least one customer requirement study a year. While, Kim (1996) found that almost 70 per cent of Korean firms investigate customer requirements at least once a year, for Omani companies the most common method used to get customer information is by salesman (37.8 per cent) followed by direct survey (28.9 per cent) and then competition (13.3 per cent), according to figure 4. In contrast, US companies are using interview methods (66 per cent) and surveys (52 per cent) more widely than Omani companies (Byrne, 1993).



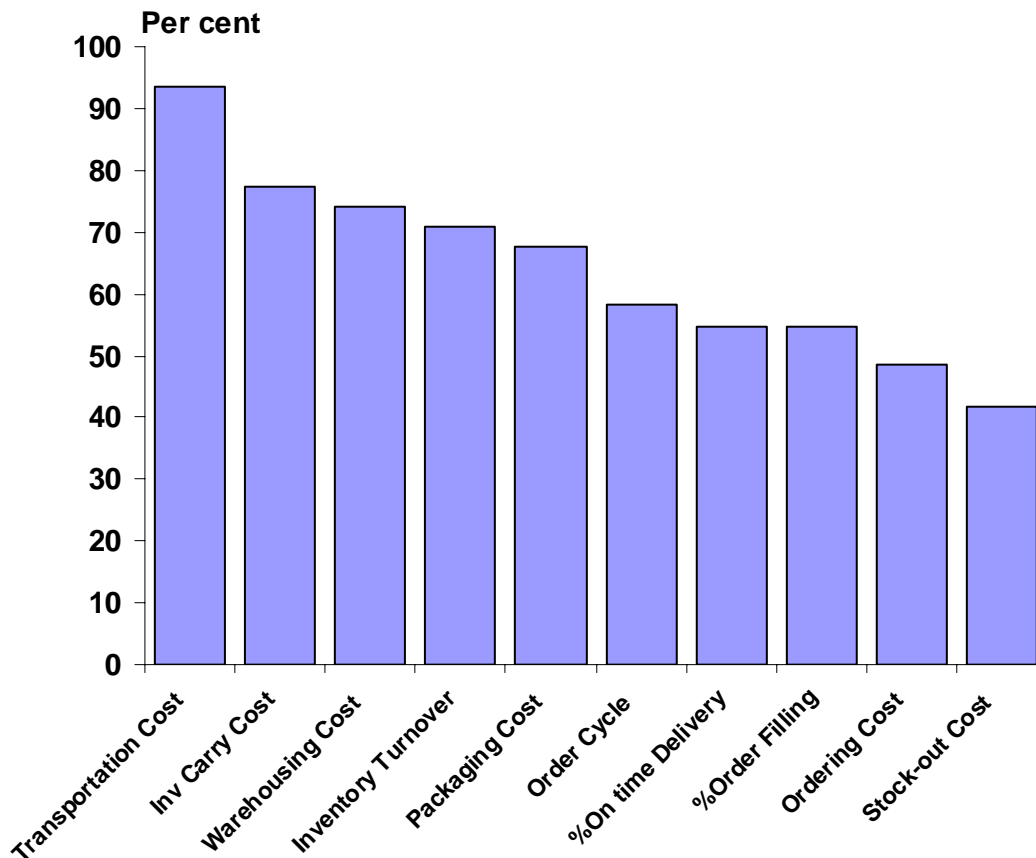
**Figure 3.**  
Frequency of customer requirements study



**Figure 4.**  
Methods to identify customer requirements

**Performance measurements:** Performance measures can be classified generally in terms of cost measures and customer service measures. A set of measures from both types were shown to respondents who were asked if they are calculated in the company. The results in figure 5 show that transportation cost is implemented by 93.5 per cent of the companies followed by warehousing cost, inventory carrying cost, packaging cost and inventory turnover with almost all falling in the seventies. After that comes, material handling cost, order cycle, % on time delivery and % order filling. In the last category, there is ordering cost and stock-out cost. On the other hand, more than 75 per cent of US companies (Bowersox et al, 1989) are using service performance measures (order fill rate, on time delivery, order cycle, and stock-out cost).

On another study (Kim, 1996), 93 per cent of Korean companies calculate transportation cost and 32.2 per cent, on average, are using service performance measures. This implies that Omani companies perform similar to Korean companies, but fall considerably behind US companies. Further, the results show that Omani companies are still putting the cost measurements in the forefront while service measurements fall behind.

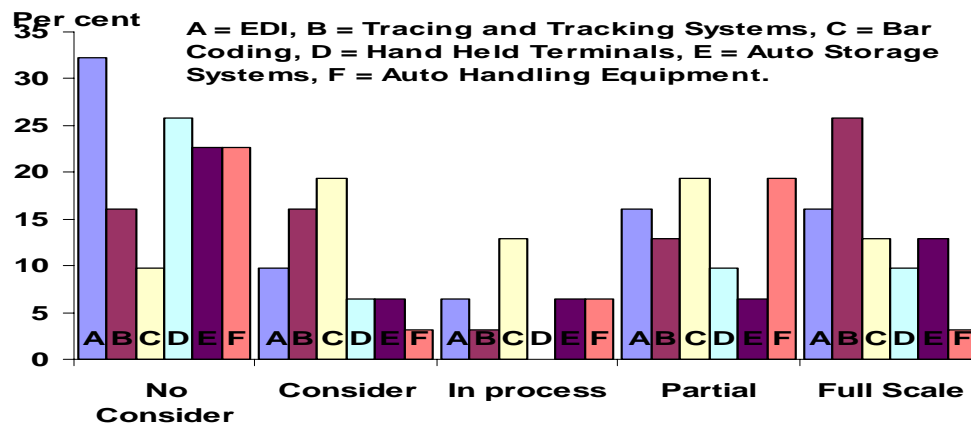


**Figure 5.**  
**Cost and service measurements**

### *Technology Adoption and Use*

**Hardware adoption:** A set of logistics hardware systems was exposed to the companies to see the degree of their spread. The results show that a maximum of 26 per cent of the companies use tracing and tracking systems followed by Electronic Data Interchange (EDI) which is adopted by 16 per cent of the companies (see figure 6). Bar coding and auto storage systems are each used by only 13 per cent of the respondents. Patterson et al (2004) found that 46.7 % of US companies use Bar coding technology compared to about 34% of Omani companies which use this technology (partial plus full scale). Further, hand-held terminals are used by 9.7 per cent and auto handling systems are used by 3 per cent of

respondents' companies. These figures indicate that all the logistics hardware presented is relatively new to the Omani industry.

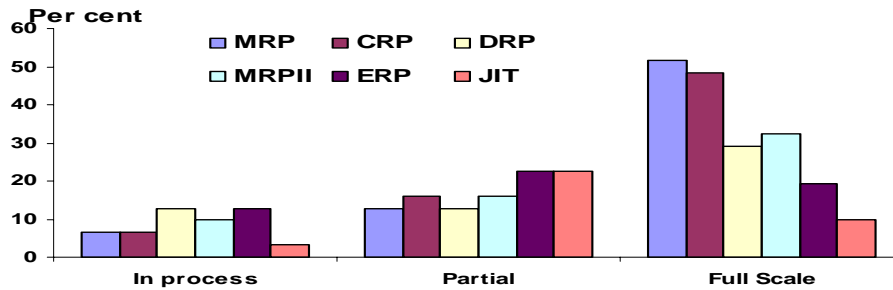


**Figure 6.**  
**Hardware Adoption**

## Software adoption

### Production Planning Software

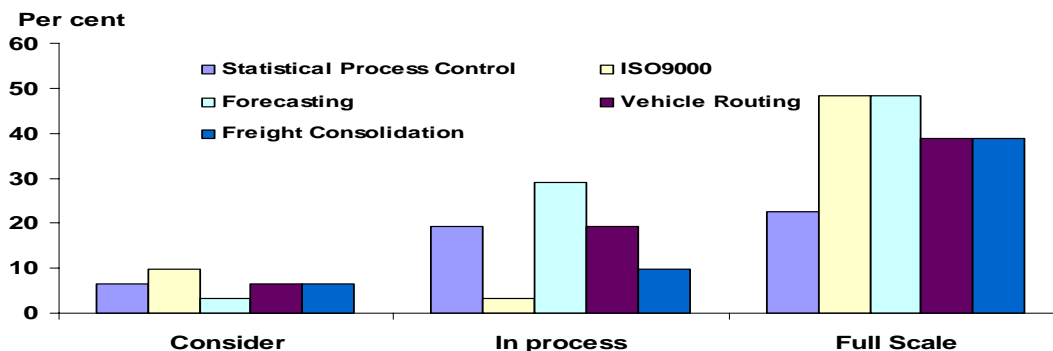
Previous studies in literature showed that the use of production planning software is related to the integration of logistics activities. This is because these software involve the use of several functions within logistics and with other departments as well. Following this, respondents were asked to rate the extent of use of four types of production software which were historically developed in a consecutive way, namely Material Requirement Planning (MRP), Capacity Requirement Planning (CRP), Manufacturing Resource Planning (MRP II) and Enterprise Resource Planning (ERP). The figure shows that the full-scale percentage implementation of the four technologies was descending from MRP (51.6 per cent), CRP (48.4), MRP II (32), to finally ERP (19.4). This indicates that most Omani companies are still in the beginning stages of these logistics technologies. Also, the relatively higher percentage of MRP and CRP shows that the companies are more concerned about the materials part of resources with less planning for machines and people. On the other hand, the percentage of companies which are *in process* or *partially* apply MRP II and ERP is greater than the percentage of the same category for MRP and CRP. This clearly shows that Omani companies are already in the transferring process toward MRP II and ERP systems.



**Figure 7:**  
**Production Planning Techniques**

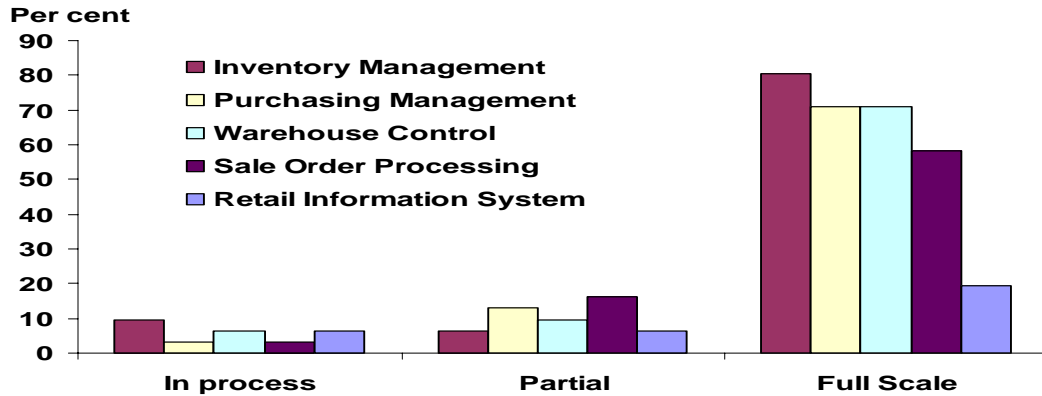
### Other Logistics software

Figures 8 and 9 show the implementation rate of several other technologies that were studied. In figure 8, the highest two implemented technologies are ISO 9000 and Forecasting (48.4 per cent for each). It is interesting to see that the implementation rate of Statistical process control is 22.6 per cent indicating that getting an ISO 9000 certificate is not related to the implementation of SPC. The figure also shows that freight consolidation software is emerging into the market with an increasing trend.



**Figure 8.**  
**General Technology**

Forecasting, on the other hand, was further investigated with regards to the forecasting methods used. The results show that 54.8 per cent of the companies use simple average, 41.9 per cent use time series, 12.9 per cent use causal models, 0 per cent use regression analysis, and 6.5 per cent conduct no forecasting analysis at all. The use of these methods resulted in a percentage accuracy of +/- 5% for 3.2 per cent of respondents, +/-10% for 45.2 per cent, +/- 25% for 19.4 per cent and 3.2 per cent of them got more than +/- 25%. The results show a high use of simple average and almost no use for regression analysis indicating a stable market for most of the companies' products.



**Figure 9.**  
**Departmental Logistics Technology**

Figure 9 shows distribution of software adoption function-wise. With the exception to retail information system, logistics software programs are being used sufficiently throughout all the functions.

#### **Technology adoption process and benefits gained**

This section goes further with technology adoption by asking questions about the technology acquisition decision-making and adoption process and the benefits gained from the adoption of logistics technology. Survey participants were given two questions in this regard; one is to rate the extent their company has an adoption process using a five-Likert scale (with 1 = Not at all and 5 = to a great extent) and the other is to rate the benefits gained from the adoption of logistics technology. The result of the first question show a mean value of 3.33 and a standard deviation of 1.15 which indicates that there is no clear mechanism for adoption process exists in the Omani companies, but the knowledge about the process is there.

Several benefit factors were shown to survey participants in order to cover the different expected benefits from the adoption. The results as shown in table 3 indicate that customer service and inventory turnover have improved significantly. Other benefit factors have improved or reduced in costs too, but with less significance. This could be because of the reluctance of Omani companies to measure the benefits used after the implementation of logistics technology.

| <b>Benefit factors</b>   | <b>Mean</b> | <b>Standard<br/>Deviation</b> |
|--|-------------|-------------------------------|
| <b>Improved customer service</b>                                     | 4.2         | 0.8                           |
| <b>Improved Inventory turnover</b>                                   | 3.8         | 1.0                           |
| <b>Reduced the cost of placing<br/>Orders with suppliers</b>         | 3.7         | 0.8                           |
| <b>Provides better understanding<br/>of our cost to serve</b>        | 3.7         | 1.0                           |
| <b>Improved shipment accuracy</b>                                    | 3.7         | 0.9                           |
| <b>Reduced Order Cycle</b>   | 3.7         | 1.0                           |
| <b>Reduced lead time from receipt<br/>of order to delivery</b>       | 3.7         | 1.0                           |
| <b>Reduced the cost of processing<br/>customers orders</b>           | 3.6         | 1.0                           |
| <b>Reduced inventory levels</b>                                      | 3.6         | 1.0                           |
| <b>Improved information sharing with<br/>Suppliers and customers</b> | 3.6         | 1.2                           |
| <b>Reduced logistics Costs</b>                                       | 3.6         | 1.0                           |
| <b>Reduced Stock-out costs</b>                                       | 3.4         | 1.1                           |

**Table 3.**  
**Benefits Gained from Logistics  
Technology Adoption**

## CONCLUSION AND RECOMMENDATION

This research is a step toward understanding the current level of logistics within Omani organizations. Through this research, several logistics factors were surveyed and analyzed, among them logistics activities ranking, strategic logistics management, partnerships, performance measurements, and logistics technology adoption and benefits. The results of this study show tentatively that Omani organizations are still at the norm level of Bowersox et al. (1989). However, the signs toward better integration of logistics activities were found to be there. The accession of Oman to WTO will bring more competition and transfer of logistics and non-logistics technology. The number of logistics service providers is expected to increase.

Through logistics activities ranking, Omani companies were found to appreciate the importance of the key activities of logistics which consist of customer service, inventory control, transportation, warehousing, procurement, and order processing. On the other hand, reverse logistics was the least ranked indicating that Omani companies are not yet aware of it. The existence of logistics management at the strategic level was found significantly above average within Omani firms, leading to the conclusion that it will not be difficult for the transfer of logistics technology to take place in the management agenda.

Omani companies tend to prefer longer relationships with their partners. 55 per cent of companies have more than 7 years relationship with suppliers and 42 per cent of them have the same

length of relationship with distributors. The relationship with service providers was more than 7 years for 26 per cent of the survey participants.

The current performance measurements used are cost oriented with transportation cost, warehousing cost, inventory carrying cost and packaging cost as the most frequently calculated measures. % on-time delivery, order cycle, and % order filling are some of the least used service measurements. In order for Omani companies to compete for customer satisfaction, they need to give equal attention to service measurements.

In the area of software technology adoption, the majority of the companies are using MRP and CRP systems. Enterprise resource planning (ERP) is used by only 19 per cent of the respondents. In fact, ERP system is the current hot software among public and private organizations in the Sultanate with some big companies already turning to SAP3. Therefore, this percentage will most likely increase in the near future. However, the current trend shouldn't be the driving force toward adopting logistics technology. Instead, the characteristics of chosen technology should flow from the needs of the company (Muscatello et al, 2003) should lead to the characteristics of the required technology. The use of logistics hardware technology, on the other hand, is minimal. EDI and Bar coding is adopted by only 16 per cent and 13 per cent of respondents, respectively. EDI is important, along with other benefits, to connect trading partners and to provide important information such as point of sale and demand visibility (Power and Simon, 2004). Bar coding has been around for quite some time as it has several benefits among them easy access to inventory items. It is important for Omani managers to look into such technologies as they can provide better customer service as well as reduction in costs.

## REFERENCES

- Anderson, DR 1984, 'Microcomputer software application in the trucking industry', *Logistics and Transportation Review*, vol. 20, no. 4, pp. 387-399.
- Ballou, RH (1999), *Business Logistics Management*, 4th edn, Prentice Hall.
- Barker, D & Smith, D 1995, 'Technology foresight using roadmaps', *Long Range Planning*, vol. 28, no. 2, pp. 21-28.
- Bowersox, DJ 1983, 'Emerging from the Recession: The Role of the Logistical Management', *Journal of Business Logistics*, vol. 4, no. 1, pp. 21-33.
- Bowersox, DJ & Closs, DJ 1996, *Logistical Management - The Integrated Supply Chain Process*, McGraw-Hill, New York, NY.



- Bowersox, D, Daugherty, P, Dröge, C, Rogers, D & Wardlow, D 1989, *Leading Edge Logistics: Competitive Positioning for the 1990s*, Council of Logistics Management, Oak Brook, IL.
- Bowersox, DJ & Daugherty, PJ 1987, 'Emerging Patterns of Logistical Organization', *Journal of Business Logistics*, vol. 8, no. 1, pp. 46-60.
- Bowersox, DJ & Daugherty, PJ 1995, 'Logistics Paradigms: The Impact of Information Technologies', *Journal of Business Logistics*, vol. 16, no. 1, pp. 65-80.
- Bowersox, DJ and Droge, C 1989, 'Similarities in the Organization and Practice of Logistics Management among Manufacturers, Wholesalers and Retailers', *Journal of Business Logistics*, vol. 10, no. 2, pp. 61-72.
- Byrne, P 1993 "Canadian logistics performance improving", *Transportation and Distribution*.
- Christopher, M 1993, 'Logistics and Competitive Strategy', *European Management Journal*, vol. 11, no. 2, pp. 258-261.
- Council of Supply Chain Management Professionals 2006, Illinois, USA, viewed 2 October, 2006, <<http://www.cscmp.org/Website/AboutCSCMP/Definitions/Definitions.asp>>.
- Dawe, RL 1994, 'An Investigation of the Pace and Determination of Information Technology Use in the Manufacturing Materials Logistics System', *Journal of Business Logistics*, vol. 15, no. 1, pp. 229-259.
- Germain, R, Droge, C & Daugherty, P J 1994, 'A Cost and Impact Typology of Logistics Technology and the Effects of its Adoption on Organizational Practice', *Journal of Business Logistics*, vol. 15, no. 2, pp. 227-248.
- Heizer, J & Render, B 2001, *Operations Management*, 6th edn, Prentice Hall.
- Kearney, AT 1984, *Measuring and Improving Productivity in Physical Distribution*, National Council of Physical Distribution Management, Oak Brook, IL.
- Kim, J 1996, 'Logistics in Korea: Current state and future directions', *International Journal of Physical Distribution & Logistics Management*, vol. 26, no. 10, pp. 6-21.
- Langley, JC 1986, 'The Evolution of the Logistics Concept', *Journal of Business Logistics*, vol. 7, no. 2, pp. 1-13.
- Mentzer, JT, Schuster, CP & Roberts, DJ 1992, 'Microcomputer versus mainframe usage in logistics', *Logistics and Transportation Review*, vol. 26, no. 2, pp. 115-131.
- Murphy, PR & Daley, JM 1994, 'Logistics issues in international sourcing: an exploratory study', *International Journal of Purchasing and Materials Management*, pp. 22-27.
- Muscatello, J, Small, M & Chen, I 2003, 'Implementing enterprise resource planning (ERP) systems in small and midsize manufacturing', *International Journal of Operations & Production Management*, vol. 23, no. 8, pp. 850-871.
- Oman Chamber of Commerce and Industry 2004, *Trade Directory 2004 of Sultanate of Oman*, Oman Chamber of Commerce and Industry, Muscat.

- O'Neil, BF & Iveson, JL 1991, 'Strategically Managing the Logistics Function', *Logistics and Transportation Review*, vol. 27, no. 4, pp. 359-377.
- Patterson, KA, Grimm, CM & Corsi, TM 2003, 'Adopting new technology for supply chain management', *Transportation Research Part E*, vol. 39, pp. 95-121.
- Patterson, KA, Grimm, CM & Corsi, TM 2004, 'Diffusion of Supply Chain Technologies', *Transportation Journal*, vol. 43, no. 3, pp.5-23.
- Power, DJ & Simon, A 2004, 'Adoption and diffusion in logistics technology: a supply chain study', *International Journal of Operations and Production Management*, vol. 24, no. 6, pp.556-587.
- Sum, CC, Teo, CB and Ng, KK 2001, 'Strategic Logistics Management in Singapore', *International Journal of Operations & Production Management*, vol. 21, no. 9, pp. 1239-1260.
- The Cooperation Council of General States of the Gulf 2006, Secretariat General, Statistical Department, Riyadh, KSA, vol. 15, Viewed 2 October, 2006, <<http://www.gcc-sg.org/gccstatvol15/TransStat/tr47.htm>>.
- Voorhees, RD, Teas, RK, Allen BJ & Dinkler, ET 1988, "Changes in the Marketing - Logistics Relationship", *Journal of Business Logistics*, vol. 9, no. 1, pp. 34-50.