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An Exploratory Study of ICT Usage in Small Logistics Service Providers

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Abstract

Information and communication technology (ICT) developments have strongly affected supply chain management (SCM) in recent years. ICT has had a great impact on all supply chain processes including planning, purchasing, production management, stock management, physical distribution and related integration management. Technology has become an important dimension of third party logistics (3PL) service supply as competitive advantage increasingly depends on the ability to create value for customers through the effective application of ICT. Within this process, while large 3PLs are gaining substantial benefits from technology usage and implementation, the magnitude of changes spurred by ICT dissemination in small logistics service providers remains unclear. This is reflected by the existing gap in literature where the role and competitive developing processes of small 3PLs are seriously underestimated. This gives rise to the need to develop research and investigation in this particular area. The objective of this paper is to narrow the knowledge gap in the field of ICT adoption in small 3PLs through an empirical investigation. It presents the results of a survey on a sample of small Italian 3PLs.

Key Words: ICT usage, Supply chain, Competitive advantage, Integration, Small logistics service providers, Italian logistics service market, Empirical survey

1. Introduction

In recent years, there has been a growing shift from traditional supply chain configurations, often characterised by fragmentation, to more coordinated and integrated approaches. This emphasis on integration puts information management at the heart of SCM contemporary approaches as it is widely recognised that ICT plays a key role in effective SCM (van Hoek, Harrison, 2004; Simchi-Levi, Caminsky, 2003; Christopher, 1992). The globalisation of supply chain architectures requires that information is shared and managed internationally. In this context, ICT is becoming a key integrative element of SCM strategy (Lee, Wang, 2000).

The application of the SCM concept has also lead to manufacturers and retailers outsourcing significant parts of their supply chain functionality to external specialised service organisations (3PLs), particularly in relation to transportation and logistics activities (McKinnon, 1999). In this frame, logistics companies play a more important role than in the past as they coordinate and accelerate physical and information flows along multiple levels of the supply chain (Cooper *et al.*, 1998). As supply chain processes and planning increasingly require real-time data availability and exchange, 3PLs are increasingly required to integrate their services with the ability to manage information flows along the entire supply chain (Evangelista, 2002). This has forced 3PLs to look for accurate and real-time information on the status of the entire shipment process. Accordingly, 3PLs are gradually shifting from an asset-based offer to a more process-oriented approach largely based on knowledge and information management.

New technologies are becoming of critical importance in the development of logistics services in a customised supply chain context. Sauvage (2003) noted that in a highly competitive business characterised by time compression, technological effort becomes a critical variable and a significant tool for differentiation of logistics services. Van Hoek (2002) assigned a specific role to ICT for 3PLs aiming to perform customising operations for service users. The author pointed out that the use of specific technological capabilities may leverage transport and logistics services and facilitate more effective integration across companies in the

supply chain. For 3PLs, ICT capabilities can assure the rapid customisation of products and maintain competitive lead-times. The result is that competitive advantage in the 3PL industry will be based increasingly on creating value for customers as many value added activities are directly or indirectly dependent on ICT applications (Crowley, 1998).

Nevertheless, the use of ICT in the 3PL sector is unevenly distributed between large and small-medium sized logistics service providers. Large firms have heavily invested in ICT and have actively developed information systems, while small 3PLs have more difficulties in setting up ICT applications due to reluctance to change and insufficient human and financial resources. This has further complicated the competitive position of small 3PLs. This situation appears particularly critical in many countries (particularly in the EU context) where the transport and logistics sector is highly fragmented, with a large proportion of small providers. This is particularly true in the Italian market. From a research point of view, while information technology in large 3PLs has been widely investigated (Larson, Gammelgaard, 2001; van Hoek, 2000; Berglund *et al.*, 1999; Peters *et al.*, 1998), there is still a shortage of research in the field of small 3PLs with little empirical investigation analysing the adoption of ICT by these companies. Considering the limited quantitative evidence about the usage of ICT in small logistics service providers, the study described in this paper attempts to fill this void through an empirical investigation developed on a sample of small Italian logistics service providers.

2. Research approach

The study presented in this paper is part of a larger research project. The basic research hypothesis of the project is that a systematic approach in selecting and evaluating ICT can leverage improvements in the competitive position of small 3PLs. The survey is aimed at analysing ICT usage in the sector and at identifying the main factors affecting technology adoption. The integration enabling role of ICT is a key focus of the study. Its specific objectives are as follows:

1. to set-up a technological profile of the surveyed companies;
2. to analyse the role of ICT tools in supporting the customisation of services; and,
3. to analyse factors influencing the adoption of ICT.

The survey methodology was organised into the following five steps:

- a) *Definition of basic survey objectives and preparation of the draft questionnaire.*
- b) *Establishment of focus groups.* . These were held in Rome and Milan in April 2004. Almost 20 key actors (ICT managers of small 3PLs, ICT consultants, directors of Italian logistics associations, researchers and academics) were involved in the two meetings. The main aim was to submit the basic survey objectives and draft questionnaire in order to get useful feedback from participants and to test the suitability and comprehensibility of the questionnaire.
- c) *Re-focussing of survey objectives and questionnaire.* Based on the focus group results, the final questionnaire contained 37 questions, divided into four sections.
- d) *Population definition.* For the purposes of the research the total population excludes very small providers - those with four vehicles or less - that are marginal in the context of the wider supply chain. The most recent reliable estimate of the total number of Italian 3PLs is 145,000 (Confetra data in Leonida, 2004). Based on this, the total population in this research is estimated at approximately 21,500.
- e) *Preparation of the mailing list.* The company information was obtained from several sources - partly from the Italian logistics associations that took part in the focus groups and partly from other sources.
- f) *Survey implementation.* The questionnaire was mailed to 1,992 companies throughout Italy. The total number of questionnaires received was 169. The final number of usable responses was 153.
- g) *Sample classification.* Within the population, a taxonomy is used on the following three categories (Sweeney, Evangelista, 2005):
 1. **Full Haulage Providers**: those companies for which transport activities represent 100% of turnover;
 2. **Basic Logistics Providers**: those companies for which transport and warehousing together comprise over 50% of turnover; and,
 3. **Advanced Logistics Providers**: those companies for which transport and warehousing together comprise less than 50% of turnover.

Table 1 shows a breakdown of the sample firms by provider type according to the above classification criteria.

Table 1
Sample Firm Classification

Full Haulage Providers	36 (23.5%)
Basic Logistics Providers	67 (43.8%)
Advanced Logistics Providers	50 (32.7%)
Total	153 (100%)

3. Survey findings

In this section, the results of the empirical investigation are presented. Following an overview of the sample characteristics, the section documents and discusses the survey results for each research objective set out earlier.

Sample characteristics

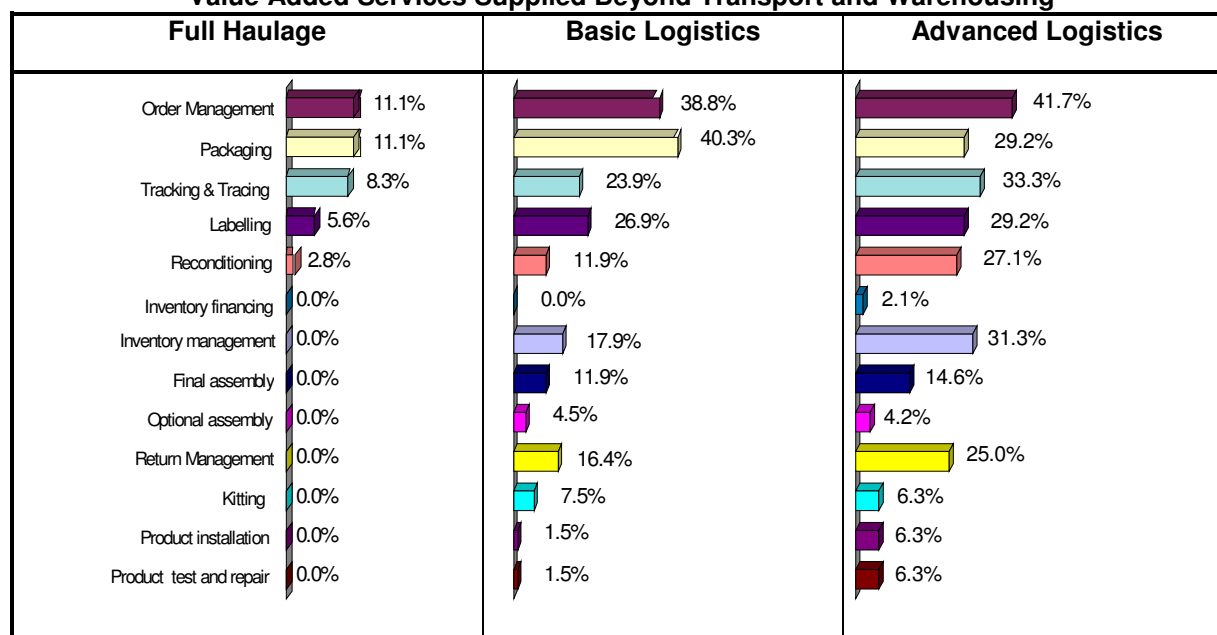
Table 2 provides details about the distribution of the sample in terms of types of provider and firm size using employee bands according to the EU definition of SMEs¹. Of the 153 respondents, almost 27% are micro companies and 42.5% are small, while about 30% are medium firms.

Table 2
Respondents by Provider Type and Firm Size

Employee bands	Full Haulage		Basic Logistics		Advanced Logistics		Total	
	N	%	N	%	N	%	N	%
Micro (less than 10)	12	29.3%	17	41.5%	12	29.3%	41	26.8%
Small (from 10 to 50)	16	24.6%	32	49.2%	17	26.2%	65	42.5%
Medium (from 51 to 250)	8	17.0%	18	38.3%	21	44.7%	47	30.7%
Total	36	23.5%	67	43.8%	50	32.7%	153	100%

Figure 1 shows the number of value added services offered beyond transport and warehousing by the surveyed companies. Moving from full haulage to advanced logistics providers the number of value added services offered increases dramatically. This supports the validity of the classification criteria adopted in this study.

Figure 1
Value Added Services Supplied Beyond Transport and Warehousing



Technological profile of the surveyed companies

Of the 100 companies that responded to the question regarding ICT costs, 36 spent less than 1% of their total costs on ICT. 11 companies spent more than 10% of their total costs on ICT. Data reported in table 3

¹ For further details, see Recommendation 2003/361/EC.

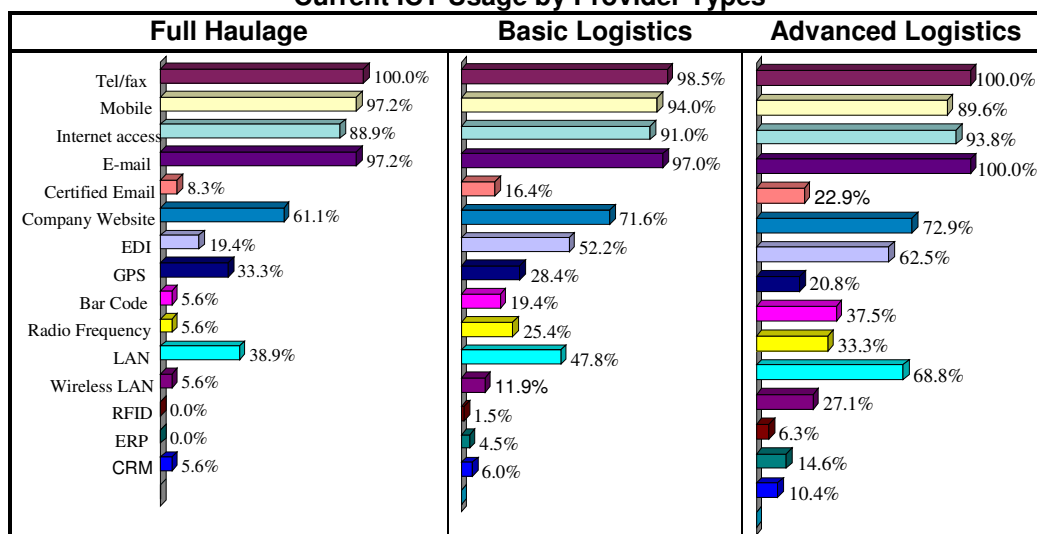
reveal that expenditure on ICT as a percentage of total company costs did not significantly vary among the different provider types ($p=38.2\%$, $\chi^2=8.55$).

Table 3
Percentage of ICT Costs on Total Company Costs by Provider Types - 2003

	Full Haulage		Basic Logistics		Advanced Logistics		Total	
	N	%	N	%	N	%	N	%
Less than 0.5%	4	16.7%	3	6.8%	2	6.3%	9	9.0%
From 0.5% to 1%	7	29.2%	15	34.1%	5	15.6%	27	27.0%
From 1.01% to 3%	4	16.7%	15	34.1%	11	34.4%	30	30.0%
From 3.01% to 10%	6	25.0%	7	15.9%	10	31.3%	23	23.0%
More than 10%	3	12.5%	4	9.1%	4	12.5%	11	11.0%
Total	24	100%	44	100%	32	100%	100	100%

Figure 2 illustrates the various ICT tools that the three provider types currently adopt in their relationships with both customers and other logistics providers.

Figure 2
Current ICT Usage by Provider Types



The data indicate a low level of usage of relatively sophisticated technologies among all provider types, particularly in the management of relationships with customers (e.g. ERP and CRM). The figure clearly shows that, moving from full haulage to advanced logistics providers, the use of more sophisticated technologies increases significantly. However, GPS is relatively widely used in full haulage providers (38.9%). This is perhaps not surprising given the importance of satellite navigation in purely transport businesses. All providers use telephone, fax, mobile, Internet and email to a great extent. In relation to other ICT tools, more than half of both basic and advanced logistics providers use EDI (52.2 % and 62.5% respectively) with similar numbers using LAN (47.8% and 68.8% respectively). The usage of these technologies is quite low for full haulage providers (19.4 % for EDI and 38.9% for LAN). Though the adoption of more complex technologies (such as Wireless LAN, RFID, ERP and CRM) is quite low in all firms, data show that these technologies are more widely used by advanced logistics providers.

Table 4 describes the degree of overall information system (IS) integration in the supply chain for different types of provider.² These data confirm that most providers have no integration with other supply chain participants (85.9%). The data indicate a significant difference among the types of provider as in the case of advanced logistics, which have the highest number of companies fully integrated in comparison with full haulage and basic logistics ($p=4.8\%$; $\chi^2= 9.58$).

² The analysis was built up using a scoring model linking IS integration to different SC participants (customer, customer's customers, suppliers and other 3PLs). The scale was based on 0 = no IS integration, 1 = partial IS integration and 2 = full IS integration. The scores for each of the four SC participants were added. Consequently, the highest level of SC integration achievable is 8. The values included in the table represent the average value of IS integration in the supply chain for each provider type.

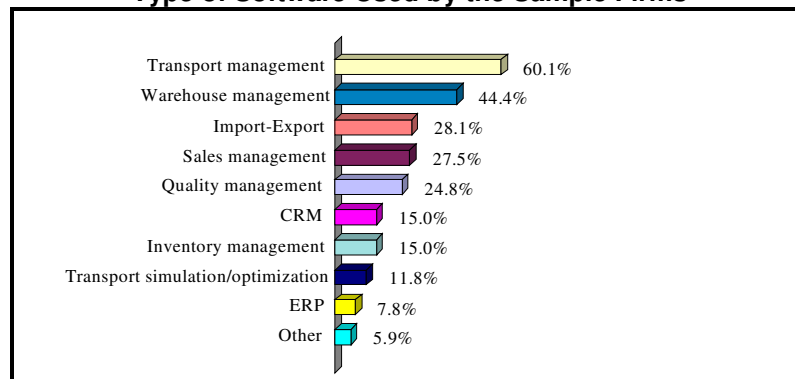
Table 4
Information Systems Integration

	Full Haulage		Basic Logistics		Advanced Logistics		Total	
	N	%	N	%	N	%	N	%
No integration	35	97.2%	58	87.9%	35	74.5%	128	85.9%
Limited integration (i.e. MRP)	0	0.0%	3	4.5%	3	6.4%	6	4.1%
Full integration (i.e. ERP)	1	2.8%	5	7.65%	9	19.1%	15	10.0%
Total	36	100%	66	100%	47	100%	149	100%

The role of ICT tools in supporting the customisation of service

In this section data relating to ICT applications used in the customisation of logistics services is presented. Amongst the most important of these tools are websites. Based on the entire sample, it emerges that 105 (68.6%) have a website in place, while 48 companies (31.4%) do not. The level of company website adoption across the different provider types is: 61.1% for full haulage; 71.6% for basic providers; and, 72.9% for advanced providers. This suggests that this technology is now reasonably well established within Italian small logistics providers. Furthermore, evidence from the survey indicates that adopters are not very innovative in the use of their website. In fact, according to the KPMG e-commerce business maturity model (Ellinger et al., 2003), this evidence confirms that the surveyed companies are still in the early stage of the model (basic marketing and publishing). Data about the software used by the sample firms highlight that 138 companies (90.2%) adopt software, while 15 companies (9.9%) do not use business software to customise their services. Figure 3 reveals that software for transport management is the most widely used among adopters (60.1%).

Figure 3
Type of Software Used by the Sample Firms



Warehouse management software is also quite widely used (44.4%). Software to manage import-export processes (28.1%), sales (27.5%) and quality management (24.8%) are also popular within these companies. Nevertheless, the types of software that have the greatest potential in terms of service customisation and interaction with customers (i.e. CRM and ERP) are not widely used.

Factors influencing ICT adoption

In this section, an overview of the main factors influencing the adoption of ICT in the sample firms is provided. Firstly, the survey analysed the factors that stimulate the use of ICT in the sample firms (see table 9).

Table 9
Factors Stimulating ICT Usage

	Full Haulage		Basic Logistics		Advanced Logistics	
	Mean (n=36)	S.D.	Mean (n=67)	S.D.	Mean (n=50)	S.D.
Higher in-company integration	1.69	1.17	2.05	1.08	1.92	0.94
Improve customer satisfaction	1.78	1.02	2.06	1.09	2.23	1.02
Improve information exchange with customers/other 3PLs	1.47	1.08	2.03	0.97	2.08	1.01
Enlarge customer base	1.00	1.07	1.37	1.04	1.44	0.97
Improve company competitiveness	1.78	1.2	1.78	0.99	1.90	1.13
Improve company's brand perception	1.25	1.22	1.49	1.11	1.65	1.10

Scale: 0 = no importance; 3 = very important

The most significant difference emerges with reference to the improvement of information exchanged with supply chain participants (namely customers and logistics providers). Advanced logistics providers attribute a higher importance to this factor in comparison with basic logistics and full haulage companies ($p=1.2\%$, $F=4.56$). A significant difference also exists with reference to the improvement of customer satisfaction ($p=14.8\%$, $F=1.92$) and to the enlargement of customer base ($p=12.0\%$, $F=2.13$).

With regard to the factors inhibiting ICT adoption in the sample firms, significant differences do not emerge between the provider classifications. The most important reasons for non investment in ICT are related to financial factors. The size of investment and the implementation costs, together with running costs, are considered the most influential factors inhibiting ICT investment. A further group of factors related to human resources - particularly the need to upgrade the technological skills of staff - seem to play an important role in inhibiting ICT expenditure. Finally, the importance given to the lack of technological standards demonstrates that the supply of ICT products and services represents a further problematic issue in relation to the wider adoption of technology.

4. Conclusion

The survey results indicate that the use of relatively advanced ICT is more prevalent in advanced providers. This is particularly the case in relation to the level of IS integration and the exchange of information with other supply chain participants. This indicates that a longer term strategic view is being adopted by more advanced providers, thus increasing the possibility that full haulage and basic logistics providers will be marginalised in the future scenario of the industry.

The results of the survey evidenced that the competitive landscape for small 3PLs is continuously changing to reflect evolving customer requirements and other business pressures. The capability of emerging ICT is increasing at a rapid rate and its effective adoption has the potential to significantly enhance the competitive capability of small 3PLs. However, it is clear that many barriers exist to the successful adoption of ICT by these providers. Furthermore, the role of ICT as an integration enabler in vertically disintegrating supply chain architectures is a source of concern. Given the importance of small 3PLs in contemporary supply chain configurations it is likely that they will quickly become the weak links unless their ICT capability is enhanced. In conclusion, if the full potential of ICT as an integration enabler is to be exploited then it is important that these issues are more fully understood. The authors' ongoing research is aimed at developing this understanding.

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