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Designing 3PL services using a market-utility approach

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Abstract

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Design/methodology/approach: A sample of 93 third-party logistics (3PL) customers from Australia participated in a controlled experiment. The research utilised a discrete choice experiement to assess the relative importance of various attributes on the selection of 3PL providers.

Findings: This study highlights the dominance of service performance in determining 3PL buyer behaviour. In particular, the results show that reliable delivery (DIFOTEF) is almost twice as important as price, and three times more important than service recovery and relationship factors in determining 3PL choice.

Research limitations/implications: Future research will examine the applicability of these finding across different markets, and examine the capabilities required to meet the customer expectations identified in this study.

Practical implications: The results of these findings can be utilised within a decision support system to assist in strategy development by predicting the impact of changing managerial actions on customer behaviour.

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INTRODUCTION

As markets become more global and competition continues to intensify, organizations have begun to realize that it is not enough to simply improve efficiencies within an organization (Li et al., 2005). The modern competitive landscape is now focused on "supply chain versus supply chain" rather than firms competing against firms (Christopher and Towill, 2001, Ketchen and Hult, 2007). For the providers of supply chain services this implies increasing complexity, as their operations are now strategically more important to a thickening web of stakeholders. The challenge is that they must not just determine what their customers want, but they must also be able to translate these demands up and down the supply chain as they interpret the needs of their customer's customers; and accordingly, the impact of the broader supply chain on the end-customer.

Furthermore, the customers of supply chain services have also become more discerning and market literate (Baker, 2003) and greater customer literacy goes beyond just a sales and marketing problem. As Godsell et al. (2006) claim, any fundamental shift in demand creation must be addressed by an equally fundamental shift in the way that demand is fulfilled. For the supply chain service provider the implication is obvious: they must work out how to get the product to its destination at a time, place and price that meets a particular customer's preferences and expectations. The key to competitive success and organizational survival is to align product and service offerings with the customer (Agarwal et al., 2006), a point made more than 50 years ago by Peter Drucker (1954) when he wrote "it is the customer who determines what the business is, what it produces, and whether it will prosper."

The operations management literature has been addressing the importance of service operations for more than 20 years. Yet, recent evidence concludes that only marginal progress has been made by this work (Machuca et al. 2007). This study explores new ground by concentrating on those factors that contribute to genuine demand for a transportation and logistic service provider or third party logistic (3PL) provider. Represented by leading market brands such as DHL, FedEx and UPS, these service providers have become increasingly important to a globally diverse range of organizations. Visible evidence of the burgeoning importance of 3PLs can be found in the multi billion dollar increase in industry revenues reported in the popular press (Foster and Armstrong, 2005, DOTARS, 2002, Logistics, 2004). Although definitions for the 3PL industry vary from broad to narrow functions (Sink and Langley, 1997, Murphy

and Poist, 1998) and tactical to strategic orientations (Bagchi and Virum, 1998, Larsen, 2000), the central theme in the literature is that 3PL includes the contracting of all or part of a firm's transportation and logistics operation to an independent service provider.

To take the next step towards a more normative positioning we require an understanding of how buyers of 3PL services trade-off between the key attributes. A major contribution by this paper is that we illustrate the usefulness of a market-utility-based approach supportive of this normative stance. Recent studies have demonstrated that market-utility-based frameworks, especially discrete choice analysis (DCA), can be very effective in understanding what customers value in both the service and operations management literatures. For example, Goodale et al. (2003) used discrete choice data to develop an improved understanding of service capacity scheduling. Iqbal et al. (2003) collected discrete choice data from over 2,000 customers across the US to show that service development and exposure to information influences the features of transaction-based e-services. Lastly, Verma et al. (2006) used campground preference data to develop a model that shows the trade-off users make between location, capacity and pricing attributes.

The remaining sections of this paper are organized as follows. The next section develops the theoretical background as it applies to our understanding of customer value in a supply chain context. Next, we describe the methodology that is used. Lastly, we discuss the results that identify the importance of this work to academics and practitioners, and then provide directions for future research.

THEORETICAL BACKGROUND

Customer value research has devoted considerable attention to developing typologies of value (Sheth et al., 1991, Holbrook, 1994, Zeithaml, 1988). In a B2B context Gassenheimer et al (1998) distinguish between business relationships that focus on economic value (i.e., minimizing transaction costs) and social value (i.e., satisfaction with the relationship compared with other alternatives). In the case of supplier choice Christopher and Peck (2003) suggest that customer value involves a trade off that is usually based on three or four market determinants.

These determinants have been termed the key success factors or market winners and successful supply chain design requires a strong understanding of their relative importance (Christopher and Peck, 2003). For example, operational excellence and customer closeness are thought to be two major drivers of

customer value in the supply chain (Morash, 2001, Treacy and Wiersema, 1995). Operational excellence emphasizes reliable supply and high levels of basic services (greater speed and quality), while at the same time reducing costs. Customer closeness is based on responsiveness, value added services, customization, flexibility, proactive solutions and dependability (Morash, 2001). These attributes are thought to reflect the ability to meet unanticipated customer needs, such as special deliveries or seasonal warehousing, which are assumed to be critical drivers of customer value (Ketchen and Hult, 2007).

Notwithstanding the valuable contributions in the literature the extant research still suffers from a lack of realism. For example, in any actual decision making process customers do not trade-off service features in isolation but weigh up a number of attributes in complex multidimensional ways. Hence, single attribute ranking methods (Vaidyanathan, 2005, Blenstock et al., 1997) or two attribute comparisons (Christopher and Peck, 2003, Mantel et al., 2006) that characterize the literature are limited because they are unable to assess customer demand for what is essentially a combinatorial problem. In this paper we propose a fresh approach to generate a better understanding of the genuine key success factors that influence choice.

The present study seeks to utilise emergent research methods to address this question and more effectively identify the relative importance of product and behavioural attributes.

METHODOLOGY

An effective method for evaluating customer demand for various service features (such as those offered by 3PL providers) is to model consumer preferences as a response to experimentally designed service profiles. This approach, commonly known as discrete choice analysis (DCA), has been used to model choice preferences of decision makers in a variety of organisational areas spanning marketing, operations management, transportation and economics (e.g., Verma et al. 2006).

The statistical model (i.e. multinomial logit) underpinning DCA draws on Thurstone's (1927) original propositions in Random Utility Theory (RUT) to provide a well-tested theory of human decision making that has been generalised by McFadden (1974). This theory allows scholars to conceptualise individual choice as a process of decision rule formation (Louviere et al. 2000). When selecting any product, service, or combination of both, a customer will consciously or unconsciously compare alternatives and make a

decision that involves tradeoffs of the components of those choices. The result of this process is a 'choice outcome' (Hensher et al. 2005), which can be decomposed based on the pattern of choices conditional on the options available.

DCA based choice experiments typically involve the following steps: (1) identification of the key attributes; (2) specification of the levels of the attribute; (3) creation of the experimental design; (4) presentation of alternatives to respondents; and (5) estimation of the choice model. Prior research has demonstrated that choice predictions resulting from DCA based choice experiments are, in general, very accurate (Verma et al., 2006; Louviere et al., 2000; Ben-Akiva and Lerman, 1991).

When selecting a logistics service provider there are many factors to be considered. For example, in any B2B purchase decision there is a series of 'logics' that interact and are traded-off in the final selection (Gattorna 2006). To capture the full range of attributes that are potentially important in the selection of a logistics service provider amongst all the alternatives available, an extensive pre-testing procedure was employed. The range of attributes selected were sourced from several rounds of qualitative work that included reviewing the academic literature, industry reports and websites, along with insight gained from in-depth discussions with experienced academics and practitioners. This preliminary work resulted in the identification of 21 attributes that were potentially relevant to the evaluation and selection of a 3PL. Best-worst scaling was used to reduce this set of attributes down to seven (see Appendix A for attribute definitions). The choice of attributes is a critical phase as the inclusion of irrelevant attributes, or exclusion of important attributes, will ultimate compromise the accuracy of the parameter estimates and the validity of the findings.

DCA applies experimental design techniques that allow us to discern the utility associated with an attribute and its levels without having to consider every possible combination of alternatives available. A near-optimal experimental design was chosen for this study (Burgess and Street, 2003). This design utilises the principles of orthogonality and asymmetry to maximise the efficiency of the parameter estimates whilst controlling for the desired number of choice sets (see Street and Burgess, 2004 for a more detailed explanation). The final design was divided into 12 blocks of 16 choice sets. Each respondent was asked to choose between two different options in which the levels of the seven key attributes were varied according to the experimental design. Table 1 provides detail regarding the levels for each of the seven attributes.

Table 1: Experimental attributes and levels

Attribute	Level 1	Level 2	Level 3	Level 4
DIFOTEF	98-100% of the time	95-97% of the time	92-94% of the time	89-91% of the time
Price Parity	Significantly higher than what you currently pay (5-8% more)	Higher than what you currently pay (0-4% more)	Similar to what you currently pay	Lower than what you currently pay (0-4% less)
Relationship Orientation	Easy to deal with, and frequently rewards the customer	Easy to deal with, but rarely rewards the customer	Difficult to deal with, and frequently rewards the customer	Difficult to deal with, but rarely rewards the customer
Supply Chain Capacity	Excellent: industry leader	Better than industry average	Equal to industry average	Below industry average
Customer Service Recovery	Very proactive: an industry leader	Better than industry average response	Equal to industry average response	Slow to respond to problems and unlikely to propose solutions
Supply Chain Innovation	Very innovative: an industry leader	Better than industry average innovation ability	Equal to industry average innovation ability	Poor innovation and unlikely to propose solutions
Professionalism	Deep knowledge of both logistics and customer's business	Deep knowledge of logistics and acceptable knowledge of customer's business	Acceptable knowledge logistics and deep knowledge of customer's business	Acceptable knowledge of both logistics and customer's business

RESULTS

Ninety-three Australian customers from an international 3PL supplier completed the discrete choice experiment resulting in a response rate of 26%. The distribution of respondents by ANZSIC industry code was as follows: logistics and transport industry (27%); wholesale and retail trade (19%); finance, insurance and property (16%), warehousing (11%); communication (10%); with the balance distributed amongst the smaller industry groupings.

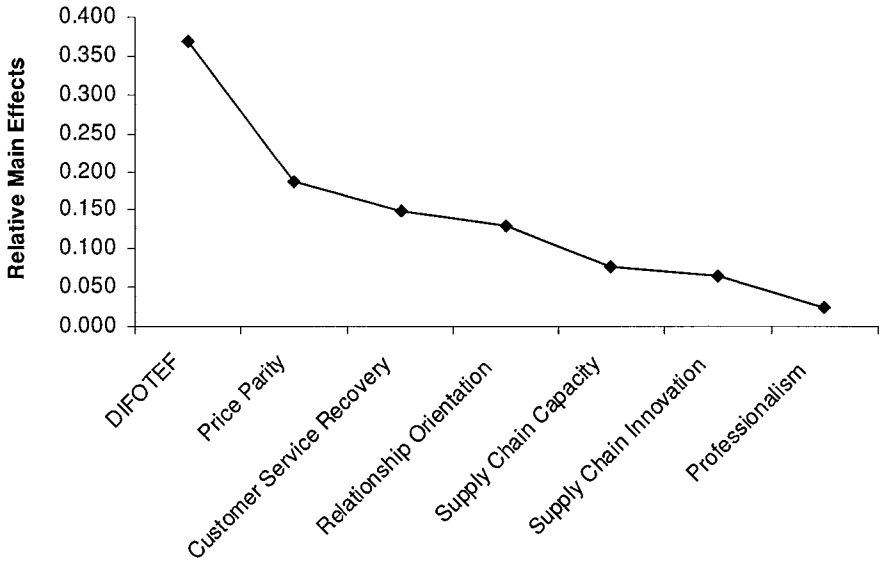
Choice Modeling Results

The main analytical technique associated with DCA is the multinomial logit model (MNL) which is a form of logistic regression based on maximum likelihood estimation (Ben-Akiva and Lerman, 1991; Louviere et al., 2000). A good applied description of DCA and MNL estimation is provided in Verma et

al. (2001) and Verma et al. (2006). Latent Gold Choice 4.0 was used to facilitate estimation of the MNL, with the relative impact of each experimental attribute and its levels presented in Appendix B for reference. The results show the normalised[1] parameter estimates for each level of the attributes, and the relative main effects for each attribute.

The linear transformation enables us to easily compare the relative impact of each attribute and its levels on a common scale amongst the entire set of attributes (Verma et al., 2006). The relative main effects results were obtained using a two-step approach. First, the range across the levels of each attribute was calculated. Second, a weighted average was obtained for each attribute relative to the entire set of attributes. The relative main effects presented in Appendix B were plotted in figures 1 to clearly illustrate the relative importance of each attribute—where an attribute with a value of 0.4 is considered to be twice as important as an attribute with a value of 0.2. This figure emphasizes the importance of attributes such as DIFOTEF, parity price and customer service recovery for buyers of 3PL services. Interestingly, the softer attributes such professionalism, capacity and proactive innovation faired less well.

Figure 1: Relative main effects for attributes

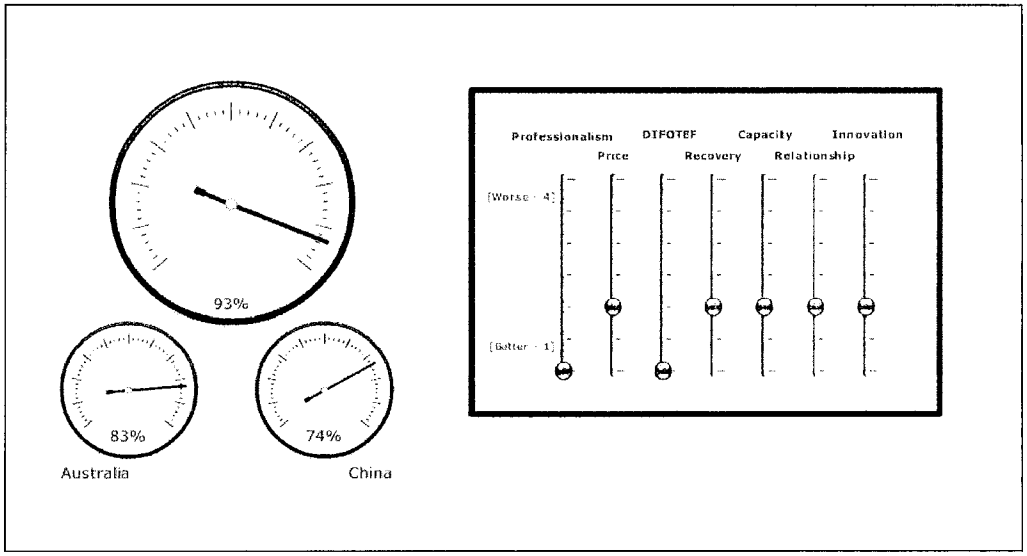


Examination of the modal normalised parameters provides valuable insights for 3PL providers interested in understanding how their customers discriminate across the levels of the attributes. Perhaps not surprisingly, the results clearly indicate that customers expect providers of 3PL services to deliver in full

and error free at least 95% of the time; to demonstrate a capacity to expand with their business; be proactive when resolving service failures; be constantly looking to provide innovative solutions; and to demonstrate a deep understanding of who their customers are and what they do. Interestingly, however, the results also indicate that customers are willing to sacrifice low prices (as long as the price is on par with competitors) in order to access these service benefits. Likewise, customers see little value in loyalty and reward schemes; preferring to work with suppliers that are easy to deal with.

The results presented above were programmed into an easy-to-use decision-support tool. This tool allows field managers to conduct various types of "what-if" scenarios to evaluate the impact of potential managerial actions. For example, from figure 2, we can see that the presented combination of attributes and levels would result in an estimated demand of 83% in Australia[2]. Interestingly, such tools can also help to evaluate the impact of managerial actions across multiple markets, with the presented in example demonstrating that an optimum combination for the organisation would result in an aggregated demand of 93% across the region, but only 74% in China.

Figure 2: Sample decision support system



CONCLUSION AND FUTURE WORK

In attempting to better understand the preferences of firms who purchase 3PL services, research to date has largely focused on price and performance related attributes. Although service performance and price are obviously important factors in a consumer's decision, it is also important to recognize that demand for

3PL services is a function of the factors that make up the experience, such as customer service recovery and relationship orientation. In particular, the results show that reliable delivery (DIFOTEF) is almost twice as important as price, and three times as important than service recovery and relationship factors in determining 3PL choice.

This study has provided greater understanding of what attributes are considered important to customers 3PL services. In particular, this study provides insight into the relative value of service delivery characteristics in realistic situations; where limited resources and competitive pressures require firms to make strategic trade-offs. These results offer several attractive value propositions to these service companies because it shows where resources should be allocated when designing service provision. The next stage of this research is to extend this approach to address the capabilities required to deliver on these customer preferences.

An important limitation in this study is the assumption that all respondents are willing to purchase services from a 3PL provider. In other words, demand is conditional on respondents 'buying' (or more accurately in the supply chain industry, simply *choosing*) a 3PL provider. Future work should provide an opt-out option to capture either unconditional demand where a respondent may desire to stay with some status quo or "not demand or require" the services of a 3PL provider.

NOTES

1. The normalised parameters are rescaled to lie between 0 – 1 so that relative importance of each attribute and its levels can be assessed on a common scale. This is achieved by applying the exponential model that underlies the MNL procedure. In other words, we divided each exponentiated parameter estimate by the sum of all of the exponentiated parameters.

2. Probability of choice (estimated demand) was calculated by entering appropriate values into a linear equation in the form;

$$f(x) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \varepsilon$$

where the X's in the above equation correspond to the attribute selections in the DSS, and the β's correspond to the parameter estimates from the MNL model.

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APPENDIX A: ATTRIBUTE DEFINITIONS

Attribute	Definition
DIFOTEF	Delivery in full, on time and error free. Complete delivery of product (or service) at the specified time agreed with the customer, and correspondingly accurate documentation.
Price Parity	Is what the customer pays for the service and/or product provided by the logistics service provider.
Relationship Orientation	Relates to the customer's perception of the ease with which business is conducted with the logistics provider and the extent to which they desire to reward and build mutual trust with their customers. The supplier can be easy or difficult to deal with; and frequently or rarely provide rewards such as loyalty schemes etc.
Supply Chain Capacity	The capability to meet unanticipated customer needs. This includes conducting special pickups, seasonal warehousing etc. The supplier can vary from industry leader to below industry average.
Customer Service Recovery	Activity aimed at identifying and resolving unexpected service delivery problems. The supplier response can vary from being very proactive towards the detection of problems and recovery; to very reactive (i.e., unlikely to propose solutions on their own).
Supply Chain Innovation	This activity refers to the provision of supply chain services aimed at providing new solutions for the customer. For example, the innovativeness of a supplier can be considered in terms of their ability to suggest new ways to deploy inventory etc.
Professionalism	Relates to the logistics service provider's knowledge of the logistics industry AND the customer's business. For example, logistics industry level professionalism would include knowledge of how to handle customs, transportation, warehousing and any other required logistics activities. Customer level knowledge refers to the depth of understanding about that customer's business.

APPENDIX B: RELATIVE MAIN EFFECTS AND BETA WEIGHTS

Attribute	Levels	Normalised parameter estimates	Relative main effects
DIFOTEF	1) 98-100% of the time	1.000	0.369
	2) 95-97% of the time	0.822	
	3) 92-94% of the time	0.327	
	4) 89-91% of the time	0.000	
Price Parity	1) Lower than what you currently pay (0-4% less)	0.668	0.187***
	2) Similar to what you currently pay	0.766	
	3) Higher than what you currently pay (0-4% more)	0.458	
	4) Significantly higher than what you currently pay (5-8% more)	0.258	
Relationship Orientation	1) Easy to deal with, and frequently rewards the customer	0.691	0.129***
	2) Easy to deal with, but rarely rewards the customer	0.707	
	3) Difficult to deal with, and frequently rewards the customer	0.358	
	4) Difficult to deal with, but rarely rewards the customer	0.395	
Supply Chain Capacity	1) Excellent: industry leader	0.616	0.076**
	2) Better than industry average	0.600	
	3) Equal to industry average	0.524	
	4) Below industry average	0.410	
Customer Service Recovery	1) Very proactive: an industry leader	0.685	0.150***
	2) Better than industry average response	0.667	
	3) Equal to industry average response	0.518	
	4) Slow to respond to problems and unlikely to propose solutions	0.279	
Supply Chain Innovation	1) Very innovative: an industry leader	0.601	0.065*
	2) Better than industry average innovation ability	0.574	
	3) Equal to industry average innovation ability	0.550	
	4) Poor innovation and unlikely to propose solutions	0.426	
Professionalism	1) Deep knowledge of both logistics and customer's business	0.570	0.024***
	2) Deep knowledge of logistics and acceptable knowledge of customer's business	0.528	
	3) Acceptable knowledge logistics and deep knowledge of customer's business	0.547	
	4) Acceptable knowledge of both logistics and customer's business	0.505	

*p<0.05, **p<0.01, ***p<0.001