CONSUMER LOGISTICS: THE TRANSPORTATION SUBSYSTEM

Donald M. Jensen, University of Utah
Kent L. Granzin, University of Utah

Abstract

This study provides an introductory view of the structure and process of the transportation subsystem of the consumer logistics system. It draws upon research findings in a number of disciplines to formulate a model that comprises five segments: Environment; Household Characteristics; Traffic Management; Transport Operations Decision; and Transport Operations Implementation. The model forms a conceptual scheme for integrating otherwise isolated research findings related to this area of consumer behavior.

Introduction

The marketing concept calls upon practitioners to recognize the importance of understanding customer needs. This understanding forms the basis for planning that creates successful marketing systems. Simply, the marketing concept states that profitability follows from satisfying customer needs. With many other competing firms attempting to attract customers, the firm that best meets their needs will achieve the greatest success. For this reason, firms spend vast amounts of money each year on consumer and market research attempting to get a clearer picture of consumers' needs.

Therefore, it is surprising to find one important area of consumer needs that has largely been overlooked by marketing scholars. This area involves consumers' participation in the movement and handling of the goods they consume. As a field of consumer activity, this area has been termed "consumer logistics" (Granzin 1984a; Jensen and Granzin 1984). Consumer logistics has been shown to find its locus in the activities of the household, activities that complement similar activities performed by a country's industrial logistics system. This set of consumer logistics activities is similar to, and often interchangeable with, logistics activities performed by business firms.

The scope of a country's consumer logistics system becomes more apparent when the common definition of industrial logistics is considered. Industrial logistics is often taken as synonymous with or as including the field of marketing logistics/physical distribution. Taff defines physical distribution as "the management of all activities which facilitate movement and the coordination of supply and demand in the creation of time and place utility in goods." (Taff 1978). But, much consumption takes place outside the industrial environment established and controlled by business firms, often within consumers' households. For example, consumers must transport most products from the point of purchase into the household. There, they engage in handling and storage of goods, commonly holding inventory stocks to prepare for future consumption needs. Therefore, consumers and their households play an important role in the performance of logistics.

A clearer understanding of the nature and the performance of consumer logistics activities can offer some unique opportunities to marketers. By knowing the role of the consumer in the distribution process, marketers can change elements of their marketing mix to better satisfy customer needs. For example, packaging can be designed to faciliate more efficient storage in the customer's home. Or, on a larger scale, the distribution activities of the firm could be altered to provide a more economic interface with the logistical activities of the household. For example, home delivery of milk products may or may not be justified for a given residential area. The optimal trade-off between assignment of logistics activities for performance by consumers versus their performance by business firms can lead to more effective operation of the economy as a whole.

The purpose of this paper is to portray the transportation subsystem of the generalized consumer logistics system. This subsystem is one of five subsystems of the consumer logistics system. The other four elements are the location, handling and storage, inventory, and communications subsystems. The reader who is interested in a brief overview of the nature of the consumer logistics system is referred to the companion paper printed in this Proceedings, "Consumer Logistics: The Location Subsystem."

The remainder of this paper contains two major sections: (1) a model of the transporation subsystem; and (2) a discussion of the implications of this study for improved understanding of the field of marketing.

The Transportation Subsystem

Taking a broad viewpoint, transportation for the household involves the movement of household members and their acquired goods through the environment. A considerable body of literature that examines consumers and their travel behavior exists. In general, the large majority of these studies focus upon either the consumer's choice of destination or on his choice of transport mode by which to get there. (Hubbard, 1978; Barff, et al., 1982). A brief review of this literature is in order.

The early studies that examined choice of destination reflected a predominantly managerial perspective (Bishop and Brown 1964). They sought to develop a model of travel behavior that would aid the selection of an optimal location of a retail outlet (Reilly 1929; Huff 1962). These early studies of consumer travel behavior likened the traveling consumer to the "rational man" of economics. According to these models, the consumer would always patronize the nearest (most economically reached) retail outlet. Subsequent empirical studies found that this postulate held true in relatively few cases (Progressive Grocer 1976; Gentry and Burns 1977-78).

Further studies found that many other factors influence the destination selected. Among these factors are income, age, and socioeconomic status (Papadopoulos 1980; Thompson 1971). Offerings of retail stores and the consumer's needs also affect travel behavior (Herrman and Beik 1968; Willard and Brown 1969; Cox and Cook 1970; Goldman 1977-78; Gautschi 1981; Odland 1981). Still other studies found desination choice related to the consumer's knowledge of the spatial environment (Bucklin 1971). Clearly, the choice of destination by the consumer is not a simple matter.

Findings from research into the selection of a mode of transportation have paralleled the results of studies of the choice of destination (Barff et al., 1982). Thus, the early models based the mode selection process on maximization of economic utility. Later studies considered a broader range of influencing factors. Demographic variables, consumer attitudes, and mode attributes have all been found to affect choice of mode (Land and Train 1976; Gensch and Recker 1979; Lave and Train 1979; Tardiff 1980; Manski and Shermand 1980; Murtaugh 1980; Kitamura 1981; Gensch 1981). Again, the choice of mode is not a simple process.

These earlier studies pertaining to the area of consumer travel behavior have produced findings that often seem unrelated or incompatible with one another. This lack of integration occurs mainly because few attempts have been made to synthesize these findings to produce a general, interrelated model that portrays consumer travel. No research previous to this paper has attempted such a synthesis within the framework of consumer logistics. By focusing on activities relevant to consumer logistics, this paper serves the larger purpose of portraying the transportation subsystem of the consumer logistic system. In the process, it produces a comprehensive model that portrays the process of consumer travel. As a result, a number of relationships not previously identified as relevant to consumer travel can be suggested as hypotheses by the model.

The Model

The model portrays the structure and process of the transportation subsystem of the consumer logistics system. **Figure 1** presents this model in graphical form, as a set of boxes and arrowed lines. The boxes represent the states of the system, and the arrowed lines connote activities. These states are positions in space (and time), while the activities represent the changes that move the system from one state to another (Granzin 1984b).

As indicated above, it appears useful to concentrate on the generalized household as a focal point for exposition of this model. The format of this section of the paper features a relatively broad portrayal of elements of the system, followed by more specific illustrations of the nature of the household-system. The illustrations focus on a presumably modal, and perhaps stereotypical, household. This illustrative household features four members: a male adult (head of household), who is the primary wage earner; his wife, who is the household manager and primary shopper; a sixteen-year-old son who has a driver's license; and a ten-year-old daughter.

The model, as shown in **Figure 1**, features five segments. First, the segment that is not bounded represents the Environment of the transportation subsystem. Second, the bounded segment labelled Household Characteristics represents attributes of the household and its members that influence its transportation behavior. Third, the Traffic Management segment contains the decisions that provide the relatively strategic basis for transportation operations. Fourth, the Transport Operations Decisions phase subsumes the decisions that govern the everyday transportation operations. Fifth, Transport Operations Implementation represents that part of the process concerned with operations. As will be discussed below, the model features two different types of decision-making. This concept was taken from the field of industrial logistics. There, the management of many transportation systems proceeds at both a policy making level and an operations level. The concept applies to household systems, as well as to business firms.

Environment of the Transportation Subsystem

The Environment of the transportation subsystem includes both the other subsystems of the consumer logistics system and the elements of the universe that are related to this system but not a part of it. Clearly, this Environment cannot be represented in any degree of detail in this model. However, the model recognizes the inputs that shape the structure and process of the subsystem under study. In particular, it contains those inputs that create the need for logistics activities.

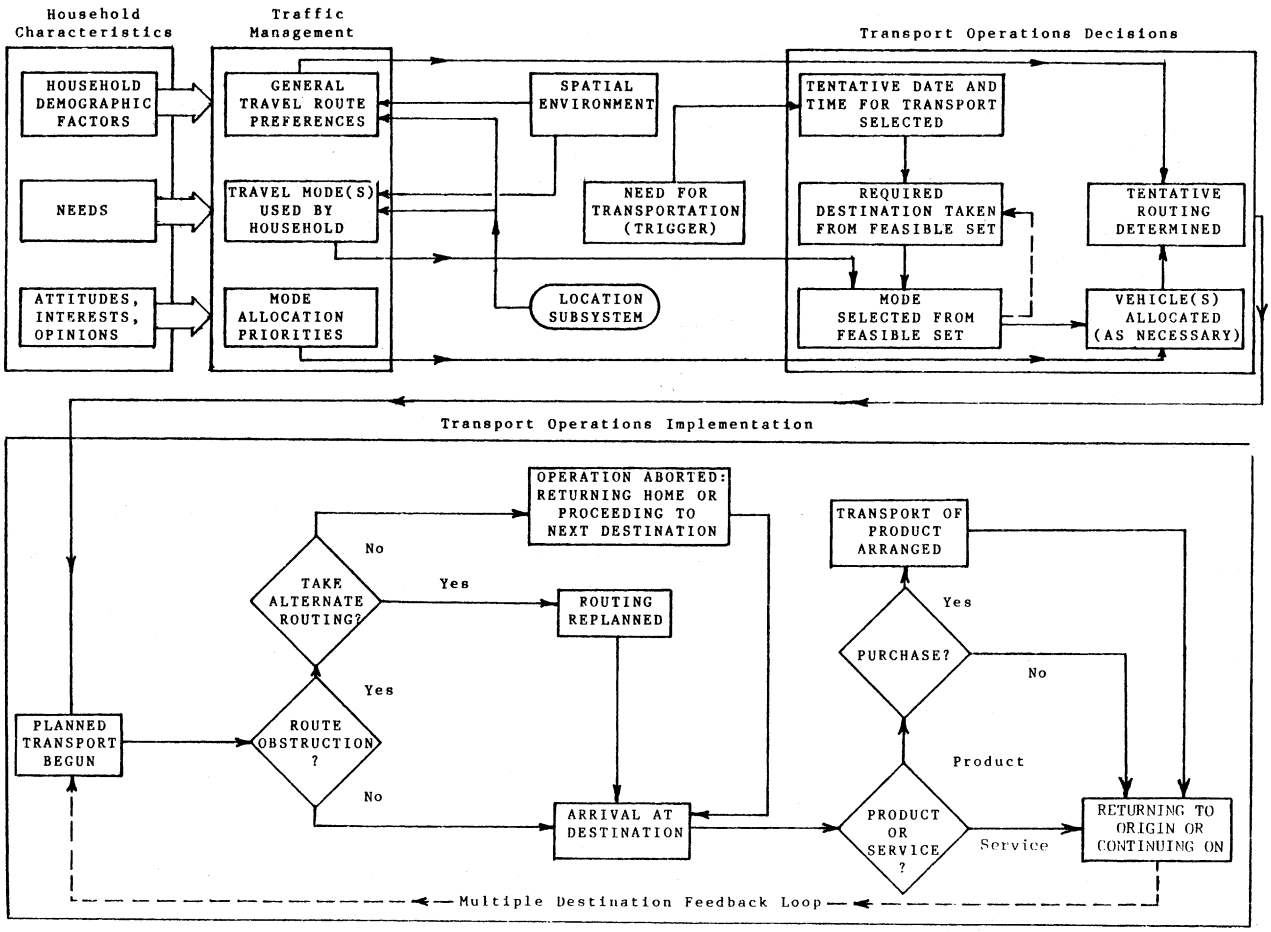
For example, the daughter may have been told at school that she can win extra credit in her Reading class if she reads three unassigned books during the next term. Her desire to read these books creates a need to obtain them, thus the necessity to perform logistical activities. While the stimulus for this need originated outside the consumer logistics system, the need acted as an input to the system via the communications subsystem, and was subsequently processed to provide an input to the transportation subsystem.

Similarly, the outputs of the transportation subsystem provide inputs to the other subsystems. If her mother drives the girl to a bookstore (location), the girl may examine the books, select one, carry it home (transportation) and place it on her bookshelf (handling and storage), where it becomes a part of her collection (inventory).

Household Characteristics

Findings from studies in the field of marketing and other social sciences have shown a wide variety of the characteristics of individuals and their groups to be generally predictive of human behavior. In particular, the references cited above have reported these characteristics to be related to behavior involving transportation. The works cited above, however, report findings that fall rather comfortably into the areas of demographics, AIO's or psychographics, and needs.

FIGURE 1
A PARADIGM FOR THE PROCESS OF THE TRANSPORTATION SUBSYSTEM



With respect to demographics, the model shows such attributes as size of household, a family's stage in its life cycle, income, type of dwelling, and type of dwelling to influence the workings of the transportation subsystem. For example, the fact that the family used for illustration has a teenager of driving age means that the boy can be used to perform some of the shopping trips necessary to support the household's consumption. Or, the type of vehicle will reflect the number of persons to be carried on a trip; e.g., to a restaurant. Lower income level will restrict the choice of transportation mode, perhaps relegating all trips to public transportation. The amount of storage space available within the dwelling may impinge upon the volume of goods purchased,and thus upon the type of vehicle that will be used.

AIO's encompass a considerable spectrum of various characteristics of persons and households. For example, the wife's attitudes toward driving would affect the means of transportation used. She may feel that small, but economical, cars are unsafe. The life style espoused by the household may call for a particular vehicle to provide transportation for both pleasure and logistical purposes. A station wagon may suit lengthy shopping trips, as well as family outings. The availability of a household member who has considerable knowledge of vehicles may govern the particular type that is selected for household use. If the husband is a "car nut", the vehicle he purchases may be a delightful toy, but not well suited for logistical activities.

Needs considered by previous studies fall into two categories. First, purely logistical needs should be considered; for example, volume of goods necessary to serve the household, the speed with which they must be acquired, and physical disabilities of household members that render them unable to use a particular means of transportation (or handling). If the husband has poor eyesight, he may not be allowed to drive a car. Second, psychological needs may also affect system operation. For example, if the wife fits the economist's model of rational decision making and the husband responds to more emotional appeals, there may be conflict over the basis of allocating the available vehicles to logistical tasks.

Traffic Management

The Traffic Management segment reflects those decisions having a more strategic nature. This

segment of the model comprises three basic elements: general route selection, mode selection, and vehicle allocation. The following two sections cover the more operational level of the transportation subsystem. Many decisions, once made, remain binding over a long period of time, even though the decisions could conceivably be reconsidered each time alternative means of performance are faced. Thus, general travel routes are those types of routes which are selected as generally preferable by members of the household. These routes may be main traffic arteries, sidestreets, or interstate highways. Similarly, the day(s) reserved for shopping trips or for travelling to consumption sites may be generally characteristic of the household. Household Characteristics affect these policies.

For example, the homemaker of our hypothetical household may prefer to avoid the congestion of the main road of her city and prefer to take side streets to the local market. Conversely, her husband may favor the larger, main streets and may use them while driving to accompany his wife on a shopping excursion. Availability of these differing routes, of course, will be determined by the spatial geography of the area frequented by the household. In the same vein, habitually taking the family outside the home for dinner on Sunday afternoons reflects a decision at the strategic level. Note that the selection of customary routes or times is the issue here. The selection of customary routes or times may be either a conscious decision, or a habit formed through repetitive

Another selection often made at the strategic level is the preferred place for acquiring products and services. While many such decisions are made on an ad hoc basis, many are made as a matter of household or individual policy, de facto or reasoned. One's favorite restaurant, clothing store, bowling alley, and automobile service facility furnish examples of destinations that both reflect and affect the route and timing of travel for logistical purposes.

Mode selection at the level of Traffic Management involves the specification of required or preferred means of transportation. The many possible alternatives include: private ownership or lease of an automobile, public transportation, use of a taxicab, sharing a ride through some form of car--pooling, cycling, and walking. The model shows these policies are influenced by Household Characteristics. For example, the young girl may ride her bicycle to the same store that her older brother reaches by automobile. Further, her father may walk to this store for reasons of exercise.

Spatial geography also affects this selection of travel model. Input from the location subsystem influences which modes are considered feasible. For example, if the family's dwelling is located near a bus route, one "family car" may suffice to serve the family's needs (pleas from the teenage notwithstanding). Similarly, living within walking distance of a shopping center and/or schools, churches, and recreational facilities may obviate the need for an additional vehicle.

Mode allocation involves setting priorities for use of limited household transportation resources. Just as for other elements of Traffic Management, Household Characteristics influence mode allocation. In our illustrative family, the parents may dictate that the adults have priority over the son in using the car should a conflict of needs for transport arise. Or, the family may develop a rational allocation scheme based on the rated importance of conflicting claims for the vehicle(s).

Transport Operations Decisions

This segment of the model focuses on the more immediate transport needs of the day-to-day operations level. The process portrayed here begins with the need for transportation, which could be a shopping trip, a trip to a physician's office, or the desire for a fast-food meal. Need arousal starts the activities of the operations level into motion. The process of the operations level begins with the Decisions phase and continues to the Implementation segment.

The first activity of the Decisions phase is to set a date and time for travel. For example, as our homemaker plans her day's activities, she decides to travel during the afternoon. After the time of travel has been determined, a destination must be selected from the alternatives available.

The destination established at the policy level may be used, or a new decision may be made. As introduced earlier, the set of destinations she considers feasible will in part be affected by her knowledge of the spatial geography. This time the homemaker decides upon a shopping center near her home. This is not the center she usually visits, but her shopping time is limited. By selecting a destination that will save her time, she effects a trade-off of (shorter) time spent travelling versus (less favorable) attributes of the place for acquiring goods.

Once the destination is known, the shopper selects an appropriate travel mode. This selection is constrained by the travel policies previously established for the household. For example, while the shopping center chosen by the homemaker is within walking distance, she recalls that her husband feels she would be safer in a vehicle. As a result, the woman chooses to take the family car. In essence, her mode selection at the operational level is thus constrained by policy decisions made at the strategic level.

When the appropriate mode has been determined, the traveller must secure a vehicle, if one is required. The priorities for this allocation that have been previously determined at the strategic level may be applied at the operational level in particular cases. In our illustrative household, the homemaker informs her son that he may not use the family car that afternoon after school, because she needs the car for her shopping trip.

The final activity in the Transport Operations Decisions phase is route determination. This element of the process involves selection of a specific route, within the bounds imposed by the management level policies. Again, for route selection, the decision process may be relatively extensively thought out, or may result from a subconscious

process. Continuing the example, the homemaker has decided to take the same route she has followed the last several times she has visited this shopping center. As there is no need to make other stops this trip, she has little need for reconsideration of the route to take.

Transport Operations Implementation

The segment of the model concerned with implementation of the decisions that have been made features several dichotomous choices that must be made on an ad hoc basis. These choices are often occasioned by unforeseen events. One information input that stimulates an operational choice is the non-availability of some required element of her shopping trip; for example, the vehicle, route, or place of shopping. The homemaker may find her car will not start, the road to her shopping center is blocked, or the store is not open for business. In the first case, her primary alternatives would be to find another mode of transportation or to cancel her plans and stay home. In the second case, she would have the choice of changing her route or returning home. In the third case, the alternatives would be to visit another store or to return home.

Suppose our homemaker finds her car will run satisfactorily, but encounters an obstruction in the road. While proceeding along her planned route, she encounters a section of the road where road crews slow traffic to a crawl. She quickly determines an alternate route via sidestreets and turns onto this route. At the shopping center, she finds the store in normal operation. Because the grocery items are not bulky, the woman carries them to her car and proceeds via a new route to her home, carefully avoiding the area of road construction.

In general, however, it may be necessary to arrange another mode of transportation for some purchases. If the woman purchases a washing machine, she will be unable to transport it in her sedan (to say nothing of the handling effort required to load and unload the item). In such a case, she might have to contract with the store of purchase for delivery. Or, she might contract with a private delivery service, arrange to return with two strong helpers and a friend's truck, or pay neighborhood teenagers to pick up the washer.

The preceding process applies to (the acquisition and transportation of) a product that will be used at the place of residence. If a service is to be consumed at a destination other than the dwelling, then transportation of the products is not an issue. In this case, the purpose of travel is to transport the consumer(s) to the place where the services will be acquired. After the services have been received, the consumer(s) may return home or proceed to another intermediate destination.

Whether a given leg of the trip involves returning to the household or proceeding to the next destination, the generalized transportion process described in this section applies. If there is but one place of acquisition, the destination of the next leg is the origin of the trip. For multiple places of purchase, the implementation process would essentially cycle continuously until the final destination (e.g., the dwelling) is reached. For example, the family may go out for dinner, attend a movie theatre, and stop for ice cream after the movie. Each leg of the total trip from home to home would involve potential application the various segments of the model.

In summary, the model of the structure and process of the transportation subsystem of the consumer logistics system contains five segments. The flow of influence begins when the inputs from the Environment produce a requirement for travel. The selection of particular activities from the available alternatives in influenced by the Household Characteristics of the individuals and the group in question. The more basic selections of alternatives occur at the Traffic Management level, where relatively long-term, broadly-influential policy decisions are made. Within this policy structure, planning subsequently takes place at the operational level, in the Transport Operations Decisions phase. The more focused choices of this segment are put into operation by the process shown in the Transport Operations Implementation segment of the model.

Conclusions

The formulation of a model of the transportation subsystem of the consumer logistics system makes several contributions to our knowledge of marketing. First, this portrayal of the transportation subsystem provides a framework which allows the integration of much of the previous work on consumer travel behavior. Second, this paper suggests a number of conceptual relationships that can usefully be subjected to empirical research investigation. Third, and more important to marketing thought, this model serves to further the conceptual development of the field of consumer logistics. This field of study offers considerable potential for contributing knowledge that will further our understanding of an important aspect of marketing behavior.

References

Barff, Richard, David MacKay, and Richard W. Olshavsky (1982), "A Selective Review of Travel-Mode Choice Models," Journal of Consumer Research, 8 (March), 370-80.

Huff, David L. (1962), "A Probabilistic Analysis of Consumer Spatial Behavior," in William S. Decker, ed. Emerging Concepts in Marketing, Chicago: American Marketing Association, 443-61.

Lave, Charles F., and Kenneth Train, (1976), Progress Report No. 2: Description of Auto Choice Model, Washington, D.C.: Energy Research and Development Administration.

Odland, John (1981), "A Houshold Approach to Destination Choice," Economic Geography, 57 (July), 257-69.

(Additional references available from the second author).