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Authors

Nesbitt, Kevin
Sperling, Dan

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Fleet purchase behavior: decision processes and implications for new vehicle technologies and fuels[☆]

Kevin Nesbitt *, Daniel Sperling

Institute of Transportation Studies, University of California, Davis, CA 95616, USA

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Abstract

Vehicle fleets are a poorly understood part of the economy. They are important, though, in that they purchase a large share of light-duty vehicles and are often targeted by governments as agents of change. We investigate fleet purchase behavior, using focus groups, interviews, and mail and telephone surveys. We categorize fleets into four different decision-making structures (autocratic, bureaucratic, hierarchic, and democratic), determine what share of the market sector each represents, describe salient features of each behavioral model, and explore implications of that behavior for industry investment and public policy. © 2001 Elsevier Science Ltd. All rights reserved.

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1. Introduction

As part of normal business operations, virtually all organizations, public and private, operate a fleet of vehicles. These vehicle fleets are widely viewed as attractive first markets for new vehicle product and service innovations, for the following reasons:

- Fleet vehicles are, on average, driven twice as far as household vehicles on an annual basis (Davis, 1995; DOE, 1993; Miao et al., 1992; FHWA, 1992), and thus the benefits derived from using a new technology (e.g., emission reductions) are maximized. High mileage accumulations also reduce the timeframe for assessing long-term vehicle performance.
- Fleet vehicles constitute approximately one quarter of all light-duty vehicle sales in the US each year, even though they represent only 6% of all registered light-duty vehicles (Miao et al., 1992;

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* Corresponding author. Tel.: +1-916-944-1796; fax: +1-916-944-1796.

E-mail addresses: kanesbitt@earthlink.com (K. Nesbitt), dsperling@ucavis.edu (D. Sperling).

Bobit, 1997), and thus high vehicle turnover facilitates rapid penetration of new technologies into the vehicle market. (Fleets also provide a conduit to the household vehicle market since most fleet vehicles are eventually sold to households.)

- A significant number of fleet vehicle purchases are by government agencies or regulated companies, which are politically more compliant than other market sectors, and thus targeting these organizations demonstrates practical applications for new vehicle technologies and services.
- Targeting fleets is efficient because less than 2% of fleets account for approximately 35% of all light-duty fleet vehicles (Bobit, 1997).
- Many fleet vehicles are regularly fueled at one location, maintained in-house, and have fixed daily routes, and thus can be switched to new fuels and vehicle types even before a public re-fueling infrastructure and service network is established.

Based on these general observations, governments have been quick to adopt mandates and incentives to hasten fleet purchases of new propulsion technologies and fuels. But fleets and fleet behavior are not homogeneous. They do not deliver the same product, provide the same service, or even operate in the same manner. Virtually the only commonality among fleets is that they operate vehicles. This diversity makes it difficult to formulate effective policies and incentive programs (see Nesbitt and Sperling, 1998). A more grounded understanding of fleet purchase behavior will lead to more effective marketing and policy strategies.

2. Objectives

This paper aims to enhance our understanding of fleet purchase behavior. The primary objective is to develop a framework for categorizing and characterizing decision-making processes used by organizations in purchasing new fleet products and innovative services. We address the following questions: Who are the key fleet decision-makers and what role do they play? What decision process do organizations follow in making these decisions? To what degree do formal rules and guidelines dictate the decision process? To what extent does the process vary depending on the autonomy of the fleet division? How is the process influenced by fleet composition and operating practices? What impact will external forces have on the final decision? To what extent do cost analyses dictate decision outcomes? These questions have not been answered within the sparse literature on vehicle fleets.

We propose a typology of organizations based on their fleet decision-making processes. The typology can be used to predict how different organizations will likely respond to government (and business) initiatives. It provides policy-makers and others a tool to evaluate how fleet problems are recognized and diagnosed, what type of analytical assessment is used in purchase decisions, where information is sought, how choice sets are formed, who participates in the decision process, and how much authorization is required. It provides a means to better understand how first-time acquisitions might deviate from a routine vehicle purchase, who will participate in the decision at various points in the process, what stimuli are needed before action is taken, and what external factors will influence the decision process.

The typology can be used to help formulate effective government policies and marketing strategies aimed at introducing new innovations into the fleet market. Although the empirical focus of this analysis is the purchase of light-duty vehicles powered by alternative propulsion

technologies and fuels, findings can be generalized to a variety of other products and innovations, including those incorporating new telematic and navigation technologies.

3. Case study of alternative fuel vehicle use in fleets

Alternative propulsion technologies and fuels are a compelling case study because the purchase issues are broad, the results visible, and the urgency to adopt cleaner vehicles continues to grow. In the past, the principal alternative fuel vehicle (AFV) choices have been internal combustion engine vehicles powered by methanol, ethanol, and natural gas. By the late 1990s, major automakers were selling electric vehicles powered by on-board batteries and hybrid electric vehicles powered by gasoline, with plans to soon start selling a broader range of hybrid electric and fuel cell electric vehicles (powered by alcohols, natural gas, petroleum fuels, hydrogen, and/or electricity) (for history and overview of technologies see Sperling, 1995).

3.1. Historical experience with government rules and incentives

Since the late 1980s, various laws and rules have been adopted at all levels of government requiring public and private organizations to incorporate low-emission alternative fuel vehicles into their fleets. The intention has been to reduce air pollution and dependence on foreign energy; in the future, greenhouse gas emissions will be added as a goal (as already is the case in Europe).

Among the national laws enacted in the US are the 1992 Energy Policy Act and the 1990 Clean Air Act Amendments. Both have provisions requiring fleets throughout the nation to purchase an increasing number of alternative fuel or clean fuel vehicles. In addition to the federal requirements, at least 25 states and dozens of cities have legislative mandates or executive directives requiring the conversion or purchase of alternative fuel vehicles for their respective fleets. However, actual purchases are falling far short of goals. The explanation is partly one of high costs and small budgets.¹ But in a larger sense, the explanation is rooted in a failure to understand fleet purchase behavior and to develop policies that effectively influence that behavior.

3.2. Toward a better understanding of fleet demand for AFVs

This study is the first comprehensive assessment of fleet decision-making within an organizational context. It is fundamentally different from previous fleet studies concerned with the marketability of alternative fuel vehicles and other vehicle-related technologies. Previous studies have focused on mapping AFV attributes to fleet travel patterns in order to estimate the potential market for AFVs (Berg, 1985; EPA, 1991; ETFUCTI, 1990; Mader et al., 1988; SCGC, 1990;

¹ Many fleets are beginning to catch up with their purchase requirements by acquiring “flexible fuel” vehicles that run on gasoline and/or alcohol fuels. In some sense, these purchases represent an evasion of the intent of the laws and rules. The vehicles appear identical to the user and are priced about the same as gasoline cars (because additional manufacturing costs are small and automakers receive credits toward their fuel economy standards by selling these vehicles), but continue to operate almost exclusively on gasoline.

UIG, 1985; Wagner, 1979, 1980). This study analyzes the vehicle purchase decision itself, leading to a better understanding of the type of organizations most likely to purchase a new technology or service under specified circumstances. It classifies fleets in a manner that is meaningful and useful for developing effective policies and implementation strategies. While studies of AFV fleet market potential are necessary and useful, knowledge of factors affecting market penetration – the degree to which market potential is realized – is imperative to formulating sound AFV policy.

This study also represents a departure from prior studies with regard to the chosen unit of analysis. Most studies and marketing efforts are premised on the assumption that the AFV issue is a fleet-level decision presumably made by the fleet manager or person responsible for day-to-day fleet activities (AGA/NGVC, 1991; LADWP/SCE, 1989; NAFA, annual; Runzheimer, 1993, 1995; SCGC, 1990; SDG&E, 1992). By focusing on the fleet manager, these studies overlook others within the organization who play a critical role in the AFV purchase decision. In most cases, important fleet decisions are made in teams rather than by one individual (Moser and Andrae, 1998).

Many of the most compelling attributes of AFVs, such as their ability to reduce vehicle emissions or enhance a company's "environmental image", mean little to the fleet manager whose primary responsibility is to keep the vehicles running at a minimum cost. Furthermore, most fleets operate on short-term budgets relative to the organization. Whereas, an AFV investment with a four-year payback period may be unthinkable for a fleet manager, it may be viewed as a prudent public relations move by upper level executives. Fleet manager opinions are important but not necessarily indicative of an organization's intent to use AFVs.

This study also departs from conventional thinking with regard to how the AFV decision is perceived. Previous studies frame the acquisition of an AFV in terms of a routine vehicle purchase. However, the purchase of an AFV will not be made in a routine manner because of the importance of the decision in terms of "actions taken, resources committed, and precedents set" (Mintzberg et al., 1976). Businesses will face a situation not before encountered for which no pre-established guidelines exist. Because of their unique attributes and potential organizational implications, alternative fuel vehicles will take fleets into the realm of strategic decision-making. Consequently, the AFV purchase decision must be analyzed from a broader perspective that takes into consideration the needs of the entire organization. This organizational approach is the premise for developing a typology of fleet decision-making structures.

4. Understanding the fleet market

Vehicle fleets are also a necessary and significant cost of conducting business. However, little is known about vehicle fleets and very little research has been conducted on the subject. Part of the reason is that vehicle fleets are diverse. They are owned by private companies, public agencies, small neighborhood businesses, and large international corporations. They might consist of two vehicles or two million vehicles; they might include anything from forklifts to long-haul heavy-duty trucks; and they serve a multitude of purposes from transporting employees to delivering heavy equipment. There is little correlation between an organization's size, the number of vehicles it has, or the function of its fleet. In fact, there is no widely recognized definition of a "vehicle fleet" or an accurate accounting of the number of vehicles residing in fleets.

The role and position of a vehicle fleet within an organization also varies considerably. The fleet may be a minor part of an organization's business or essentially the whole business (e.g., taxi services). Fleet management responsibilities might be assigned to administration, finance, sales, operations, or purchasing departments; because each department has different goals and objectives, they will often make very different purchase decisions. Indeed, fleet managers themselves are diverse, representing a wide spectrum of backgrounds, including many promoted from other positions within the organization. Larger organizations dedicate a full-time position to fleet management while others assign the duty to an employee who already has other job responsibilities.

Adding to the complexity is the fact that fleet composition is not static. Historically, organizations have altered their fleet programs in response to changes in the economy and tax law reforms (Chaudier, 1989; Runzheimer, 1993). This is accomplished by changing the number and type of vehicles, as well as the ratio of owned, leased, and employee-provided vehicles. Organizations also divide or consolidate fleet sites when there is an economic reason to do so. They might also do so in response to new government directives and incentives. Many fleet operators participating in this study indicated that they would make operational or administrative changes in order to circumvent AFV purchase mandates.

5. Categorizing and characterizing fleet decision-making

Historically, researchers have categorized vehicle fleets using simple distinctions such as the purpose, composition, and size of the fleet or the service provided by the organization (Bobit, annual; Miao et al., 1992; Runzheimer, 1993; Shonka, 1980). Typical (overlapping) fleet categories are based on vehicle function (emergency services, delivery vehicles, service vehicles, rentals), organization type (government, business), fleet size (total number of vehicles), and vehicle type (light-duty vehicles, trucks). No distinctions are made based on ownership or geographic location. Therefore, one company may claim ownership of several different "fleets" operating at one location or, conversely, claim ownership of a single fleet that is dispersed across the country through branch offices.

Our classification scheme does not attempt to categorize fleets by function, size, or vehicle characteristics but rather distinguishes fleets by the different decision-making structures that determine their behavior. Decision-making structure has to do with where decisions are made within the organization, who influences those decisions, and the degree to which systems and procedures facilitate decision-making.

Organizational decision-making behavior has long been described in terms of contextual dimensions. Two of these dimensions – centralization and formalization – have been found to be particularly compelling in defining an organization's dominant decision-making structure (Fredrickson, 1986; James and Jones, 1976; Langley, 1990; Mintzberg, 1979; Pugh et al., 1968; Shrivastava and Grant, 1985). We found these two dimensions to be good indicators of a fleet's decision-making behavior and thus they motivate our typology.

We define formalization as the extent to which rules and procedures guide the fleet decision process. Fleets with formalized decision-making behavior usually codify rules and procedures as written policy. At higher levels of formalization, decisions are generally initiated only in response

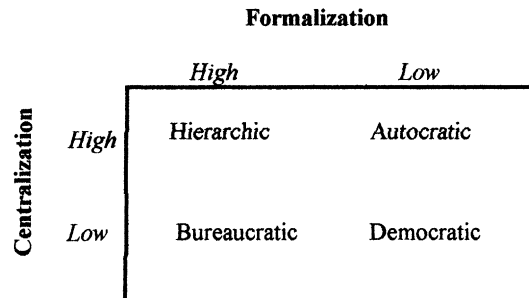


Fig. 1. Typology of fleet decision-making.

to problems that disrupt standard operating procedures. Solutions engender only incremental change and are sought in response to precise problems (Fredrickson, 1986; Quinn, 1980). Problem resolution follows formal guidelines and usually begins with an attempt to apply previous solutions, which resulted in favorable outcomes (Cyert and March, 1963). The process usually involves heavy analysis and several levels of authorization. In highly formalized decision structures, the process is almost as important as the outcome (Fredrickson, 1986). In less formalized organizations, decisions are guided more by intuition, personal judgment, and political bargaining.

Centralization has to do with the number of people involved in fleet decisions and their decision-making autonomy. A decision-making structure is considered highly centralized when decisions are made at a single point in the organization by one or two individuals without further authorization, and decentralized when the process involves several individuals and departments. Other indicators of centralized decision-making: decision processes are initiated by only a dominant few; decision action results from proactive opportunity-seeking behavior; solutions emphasize “positive” goals (rather than immediate fixes); solutions result in major departures from existing circumstances; decisions are highly integrated with the goals of the organization; and cognitive limitations prevent optimal solutions (Fredrickson, 1986; Mintzberg, 1979).

There are four possible configurations of centralization and formalization. These four decision-making structures form the basis of our typology (see Fig. 1). In the following section, we describe the analysis used to develop and validate this typology.

6. Research approach

Our study comprises two main components: a qualitative assessment of fleet decision-making, and a quantitative analysis of fleet decision structures. The first qualitative stage included a series of focus group sessions and one-on-one interviews, which were used to formulate a working typology. In the second stage, the typology was tested using additional focus groups and interviews, and a statewide fleet survey.

Organizations queried in our focus groups, interviews, and surveys include state and local governments, public utility companies, small and large businesses, and non-profit organizations (see Nesbitt, 1996, for details including a complete list of the organizations that participated in this part of the study). Special efforts were taken with focus groups and interviews to include

organizations with small vehicle fleets (less than 10 vehicles), which most studies ignore because they rarely belong to industry associations (from which sampling frames are generated) and are difficult to distinguish from private households. A combination of sources was used to create a sampling frame for preliminary interviews and surveys, including industry mailing lists, trade journal subscription lists, government databases, and local telephone directories.

6.1. Focus groups and preliminary interviews

In all, 59 individuals participated in seven focus group sessions, and another 39 participated in one-on-one interviews. Each was identified as a key decision-maker in purchasing new vehicles; they were business owners, fleet managers, purchasing department personnel, finance department personnel, environmental analysts and mechanics. They were questioned about decision-making procedures, fleet responsibilities, standard operating procedures and policies, fleet autonomy within the organization, knowledge of government rules and policies affecting fleet acquisition of AFVs, knowledge of AFV technology, sources of information, primary concerns and considerations, strategies for implementing AFVs, purchase incentives, and likely reactions to various implementation scenarios. Background information was also collected on each organization and respective vehicle fleet.

6.2. Survey data collection

Following the focus groups and interviews, an extensive multi-part survey was administered to fleets in California to test the proposed typology. The survey was jointly designed by research teams at UC Irvine and UC Davis to pursue complementary research goals (see Nesbitt, 1996; Golob et al., 1997). The survey-sampling frame was taken from vehicle registrations procured from the California Department of Motor Vehicles (DMV). Registration records provided a good sampling frame. The sampling frame for previous fleet surveys typically consisted of rosters from industry associations, government agencies, and private research firms. Careful scrutiny of those rosters found them to be inaccurate, incomplete, and generally unacceptable.

Careful measures were taken to ensure that the primary fleet decision-maker was the one who responded to the survey, where more than one decision-maker was identified, efforts were taken to include all those capable of influencing the decision outcome. This was accomplished through a screening protocol, where organizations were contacted to collect background information and to identify the fleet decision-maker(s). At this time a computer aided telephone interview (CATI) was conducted. The initial CATI resulted in 2711 completed interviews, which corresponded to a 71% completion rate once the eligible fleet decision-maker was identified.

The second part of the survey consisted of a seven page mail questionnaire which was administered to 2708 fleet sites that consented to do so during the CATI interview (see Nesbitt, 1996, Appendix B for the CATI and mail questionnaire). Of the 2708 organizations sent a mail questionnaire, 2131 were returned, a 78% response rate. Of these, 2117 were deemed usable. Fleet survey response rates are usually less than 10% (NAFA annual; Runzheimer, 1991, 1993, 1995; Shonka, 1980; UIG, 1985; Wagner, 1979).

Table 1
Typology category characteristics

		Bureaucratic	Autocratic	Hierarchic	Democratic
(1)	Formal written rules guide fleet decisions	Yes or no	No	Yes or no (no, if 2 and 3 are yes)	No
(2)	Detailed cost analyses are used	Yes	Yes or no	Yes or no (yes if 3 is no)	Yes or no (yes if 3 is no)
(3)	Final choices are made after soliciting bids	Yes	Yes or no	Yes or no (yes if 2 is no)	Yes or no (yes if 2 is no)
(4)	Decisions are made by only 1 or 2 individuals	No	Yes	Yes	No
(5)	Decisions are made at upper management levels	Yes or no	Yes	Yes	Yes or no
(6)	Little or no authorization/approval is necessary	No	Yes	No	No
(7)	Decisions are made at headquarters but implemented at individual fleet sites	Yes or no	Yes or no	Yes or no	Yes or no

6.3. Data analysis

Seven questions were inserted into the mail questionnaire to measure the level of formalization and centralization of each fleet's decision-making process. The questions asked about the importance of cost analysis in decision-making, whether a bidding process is used, the number and organizational status of people who normally participate in strategic fleet decisions, how much authorization is required for such decisions, and the decision-making autonomy at each fleet site. Respondents were asked to consider "important fleet decisions" that had "significant cost implications or resulted in substantial changes in fleet operations". Two examples were given – the installation of on-site refueling facilities and the decision to invest in alternative fuel vehicles.

The questions provided a means to test the proposed decision-making typology. Responses to the questions were used to determine how many of the surveyed fleets "fit" into a single category of the typology. Typology fit was determined using response pattern frequency computations and cluster analyses. Results show that the proposed fleet decision-making typology performed exceptionally well (see Nesbitt, 1996, for detailed results). The main characteristics of the four-fleet categories are shown in Table 1.

7. Two decision factors: importance and urgency

7.1. Decision importance

Others have shown how the importance and nature of a decision – the complexity, novelty, scope, political ramifications, resource commitments, and organizational consequences – directly affect the length of the decision process, how repetitive it is, and the number of interruptions and delays (Hickson et al., 1986; Mintzberg et al., 1976). Whenever governments promote new vehicle

products and services to fleets (and others), presumably in pursuit of social goals, fleets treat these purchases as strategic decisions. Strategic decisions are generally novel, complex, substantial, and unprecedented (Kleindorfer, 1993). They determine future courses of action, occupy the thinking of upper management, involve significant resource commitments, and impact a relatively large portion of the organization. This implies that the prospective purchase of an AFV will be a significantly different decision than the purchase of a conventional fleet vehicle.

Although this study is concerned more with decisions resulting in significant change such as the implementation of new operating procedures or the acquisition of nascent technologies, decision importance is likely to change over time. The initial AFV purchase will likely be a strategic decision made at the upper management level but, as AFVs become more common place, succeeding AFV purchases will eventually become routine. As the decision slides down the company hierarchy, different purchase criteria may come into play.

7.2. Decision urgency

Fleet decision paths are determined not only by decision structure and issue importance, but also by the urgency and stimuli that evoke the decision. Mintzberg et al. (1976) note that these stimuli are best represented by a continuum. At one extreme are opportunity decisions, those undertaken on a purely voluntary basis to improve a situation that is already satisfactory. At the other extreme are crisis decisions, which are associated with high-pressure situations and demand an immediate response.

So far, almost all AFV purchases have been the result of opportunities. Organizations view AFVs as a way of improving corporate image, complying with regulations such as worktrip reduction ordinances, gaining exemptions from traffic control measures, or investing in bankable emission credits. Many fleets that purchased flexible-fuel vehicles simply decided to take advantage of temporary subsidies and tax breaks offered by local or state governments. Utility companies with large fleets of electric and natural gas vehicles are pursuing an opportunity to capture a larger share of the energy market.

However, motives for exploring AFV options can change if opportunities are pre-empted by problems and perhaps even crises. It is reasonable to postulate that pending AFV purchase requirements will increase the urgency of the AFV issue. Opportunities will be transformed to problems as the need to meet AFV quotas propels the AFV issue to the top of the organization. These problems could eventually erupt into crises when mandatory AFV purchases loom closer.

As the AFV decision takes on a greater urgency or becomes a “crisis” situation, the decision process decreases in time. Much of this reduction will likely be realized at the front end of the decision process during the problem recognition phase. Crisis situations generally require fewer stimuli to provoke the decision process and generally do not require as much diagnosis. Also, less effort will be devoted to searching for the optimal solution because pressures will motivate the organization to settle for the first satisfactory solution. More emphasis will be placed on solutions that have been implemented successfully in other fleets. Turnkey solutions will be heavily favored over those requiring even minor changes in fleet operations.

In an expedited decision process, decision choices are collapsed to only a few alternatives, reducing the need for extensive quantitative analysis. Judgment decisions will likely meet less

resistance and be rushed through the authorization process. Levels of authorization may be waived. In short, as urgency increases the decision process becomes more streamlined.

We have discussed three important factors that determine the decision path: the fleet decision structure (fleet typology), the importance of the decision (strategic, tactical, routine), and the urgency of the decision (opportunity, problem, crisis). All are inextricably related and determinant of the decision path taken. In the following section, we assume that the initial AFV purchase decision is strategically important but not highly urgent, and explore how various decision structures will likely affect decisions.

8. Autocratic decision-making structure

Autocratic decision-making fleets comprise 10% of our survey sample. However, the sample only included fleets of 10 or more vehicles. We hypothesize, based on our focus groups and interviews, that the majority of small fleets (less than 10 vehicles) have autocratic decision-making structures, and thus the true number of fleets in this category is considerably more than 10%.

Fleets with an autocratic decision-making structure exhibit very informal, highly centralized decision behavior. Decisions are typically made by one individual (e.g., the business owner) who is familiar with and fully responsible for day-to-day fleet operations. Solution choice sets are shaped around this individual's perceptions and interests. The decision-maker usually has several important non-fleet-related responsibilities and, therefore, does not have a substantial amount of time to devote to fleet issues. The vehicle fleet is often considered a low priority that demands attention only when something goes wrong.

Autocratic decision-making behavior is prevalent in small owner-managed private businesses with functionally simple organizational structures and few levels of management (such as the small fleets mentioned above). These organizations tend to be "high in centralization and low in both formalization and complexity" (Mintzberg, 1979). Good examples of organizations with an autocratic fleet decision structure are independent local businesses that offer services such as landscaping, plumbing, and appliance repairs. These organizations usually have a small vehicle fleet and travel needs that seldom extend beyond the local vicinity. Employees often take vehicles home at night.

The autocratic fleet decision-maker is usually influenced more by past experiences and recommendations from colleagues than by the systematic comparison of viable options. Intuition and personal judgment replace rigid analysis for evaluating alternatives. Outcomes are often a reflection of the decision-maker's personal likes. In this regard, vehicle purchase closely resembles that of a private household, where brand loyalty, vehicle reputation, and personal tastes are often as important as economic factors.

Because the autocratic decision process involves only one or two individuals, decision times can be short. The decision environment is non-political and the final selection requires little if any approval. The autocratic decision-maker is uniquely qualified to make choices, which maximize the organization's objectives because she/he usually has an excellent understanding of those objectives. Therefore, decisions are consistent and integrated with company goals. There is little resistance from other employees during the decision process or implementation.

Because the decision is not encumbered by formalized procedures, extensive evaluation, or politics, it is more likely to be motivated by proactive opportunity-seeking behavior. This leads to greater potential for major changes, as opposed to incremental departures from existing circumstances. The streamlined centralized decision process also enables organizations to move quickly when faced with rapidly evolving technologies. Although this enables quick implementation of new technologies, it can also lead to “last minute” decisions. More importantly, solution development is limited by the cognitive abilities of only one or two decision-makers.

8.1. Implications for autocratic decision-making

Autocratic fleet decision-makers do not rely on support from staff, advisory committees, or field experts to identify problems and search for solutions. They belong to fewer fleet associations and subscribe to fewer industry publications than other fleet types. Relatively few employees act as the company’s “eyes and ears” in collecting outside information. Thus, knowledge of AFVs comes from familiar places, primarily well-established networks within their business communities. These information contacts will likely be fellow business owners rather than full-time fleet managers who would be more aware of fleet industry news. As a result, information received by the decision-maker may be outdated, incomplete, or even inaccurate. Special efforts are needed to disseminate information to these businesses that fall outside mainstream information networks.

Autocratic fleet decision-makers purchase vehicles much like private consumers, and therefore are predisposed to the same purchase habits. Due to time and resource constraints, the autocratic fleet decision-maker will likely consider only one or two specific AFVs. These will most likely be AFVs that have successfully been used in other fleets familiar to the decision-maker. Autocratic fleets will likely copy AFV solutions implemented elsewhere. They will not be the first to purchase an AFV because of limited financial resources. Instead, autocratic fleets will likely defer AFV decisions until potential benefits are proven elsewhere. They feel that the “big guys” (large fleets) are better equipped to deal with the uncertainties of nascent AFV technologies and, therefore, should be the “guinea pigs”. Autocratic fleets are more apt to wait for one technology to “win out”: they fear being abandoned with a “technology orphan”. The overall attitude of the autocratic decision-making fleets is best summarized as “wait and see” skepticism.

Although autocratic fleet decision-makers appear to be very cost conscious, they seldom have full or accurate knowledge regarding their own fleet costs. Many autocratic fleets do not understand the concept of life-cycle costs, do not believe it applies to them (“we do not keep vehicles long enough”), or do not think that it is important. Autocratic fleets typically do not keep detailed records of operating costs or conduct any type of analytical cost assessment when making purchase choices. In fact, very few even monitor vehicle costs or use any type of computational analysis for tracking expenses. Instead they preclude certain vehicles from the final choice set based on negative experiences such as frequent breakdowns or high repair bills.

Therefore, the final vehicle selection by these fleets will likely be made based on a comparison of purchase prices. Other vehicle attributes and costs will be traded-off in the decision-maker’s head. This puts AFVs, which tend to have higher upfront costs but lower operating costs, at a distinct disadvantage, even when lifecycle costs are favorable. This finding underscores the importance of providing autocratic fleets with financial incentives that help defray upfront capital costs.

Autocratic fleets generally assign little value to corporate image benefits associated with AFVs. Although their expressed concerns for cleaner air were as strong as other fleet operators participating in this study, they were least inclined to purchase an AFV for public relations benefits. On the other hand, they are most susceptible to hearsay and rumors. Throughout the interviews and focus groups, several autocratic fleet decision-makers dismissed certain AFV options because of negative stories (some true, some false, but most exaggerated). Small autocratic fleets tend to be influenced most by rumors because they do not have as much access to reliable AFV sources as other fleet types.

Small fleets with autocratic decision-making structures should not be ignored as potential candidates for AFV purchase. They generally will not be the first to adopt AFVs, but may be quick to follow the lead of others. Small entrepreneurial-type businesses often engage in risky propositions; in fact, their very existence is usually due to an inherently risky venture (Mintzberg, 1979). These types of organizations operate in dynamic environments, where change and adaptation are often necessary to survive in very competitive markets. This environment is ideal for innovative change, and because autocratic fleet decision-makers are usually directly involved with fleet operations, incorporating an AFV (with different operating considerations) into the fleet may be facilitated. The key is better information for these fleets and incentives that focus on reducing the vehicle purchase price.

9. Bureaucratic decision-making structure

Of our mail survey fleet respondents, 33% have bureaucratic decision-making structures. (If state and federal government fleets had been included in our survey, the proportion would likely be much higher.) Bureaucratic fleets, generally the largest in the survey, are common amongst public and institutional organizations. In fact, 44% of all the bureaucratic-type fleets in the survey belonged to a local government agency or non-profit organization. Representative fleets include universities, utility companies, public transit authorities and non-profit organizations.

Unlike the autocratic decision structure, bureaucratic decision-making is highly formalized and decentralized. Whereas, autocratic fleets rely on personal judgment to reach decisions, bureaucratic decision outcomes are the result of objective formal evaluations carried out systematically through pre-established routines. Company policies dictate the bureaucratic fleet decision process and centralization gives way to formal procedures. Official rules and standard operating procedures determine the activities, information flows, and interactions of the decision process. There is heavy reliance on precedent. Actions taken today by bureaucrat fleets are largely determined by a long history of activities, the outcomes of which are reflected in the organization's official rules and guidelines (Allison, 1971; March and Shapira, 1992).

Like the autocratic fleet, the bureaucratic decision-making fleet operates in a "satisficing" mode rather than emphasizing goal optimization (March and Simon, 1958). Information searches are usually confined to areas previously utilized and favor quick fixes or incremental changes over more forward-looking long-term solutions. Technical evaluations, financial assessments, and cost-benefit analyses are often a part of the decision process. A practice common to all bureaucratic fleets is the solicitation of bids for major purchases. Specifications are drawn, a bid is let, and a contract is awarded to the lowest bidder capable of fulfilling the contract requirements.

Bureaucratic decision-making is hierarchically dispersed among individuals from different organizational levels, departments, and/or geographic locations. There is no single “decision-maker” but rather several people who influence the decision outcome. Decisions usually flow from the top-down although the stimulus that triggers decision action can occur at any level. Typically, several departments (e.g., the finance department) must approve decisions, and final choices are subject to many levels of formal authorization. Final authorization is often a formal procedure carried out by individuals far removed from the issue. However, the final decision is not made by these individuals any more than the “choices of the individuals are made by the hands that sign the papers” (March and Shapira, 1992).

Because bureaucratic fleets tend to involve several people and departments, there are many places where a decision can be interrupted, delayed or terminated. The multiple levels of approval required present a barrier to innovative change. A chain of “yes’s” is required to implement a new idea while only one “no” is needed to reject it. A number of different departments and managers could prolong an AFV purchase whether or not it directly affects them.

The bureaucratic decision-making structure is common amongst government agencies and large highly functionalized, mechanistic-type organizations with several levels of specialization (Inkson et al. 1970; Mintzberg, 1979; Pugh, 1969). It is also common amongst old large private sector firms in mature or regulated industries (Shrivastava and Grant, 1985). A disproportionately large number (54%) of all government fleets surveyed were classified as bureaucratic decision-makers. This decision-making structure is also prevalent amongst fleets of non-profit organizations. These organizations often depend on government funding and thus mimic the fleet management methods of those government agencies. In fact, many procure vehicles by “piggybacking” on government bids.

In situations where the organization has more than one fleet site, fleet policies are usually established centrally and administered locally. Of all the bureaucratic fleets in the survey sample, 76% had a central headquarters location. Of those, 67% indicated that strategic decisions are made at their headquarters but implemented at individual fleet sites. Because decisions are instituted uniformly, each individual fleet site is a potential “decision interrupt”. If just one fleet site is unable to adapt to a particular outcome, then the organization may have to reconsider the proposed solution. Because the needs of each fleet site must be met, decision outcomes are usually limited to only minor changes.

The main barrier to innovative purchases in the bureaucratic decision-making structure is the reliance on pre-established procedures. Conditions that set off decision actions are largely pre-determined. Programmed responses are activated only when critical variables get outside some specified range recognized by the system (Steinbruner, 1974). Consequently, solution development is likely to be motivated by reactive behavior and focus on short-term immediate fixes. Such a structure serves well for improving efficiency in performance-oriented organizations but is not conducive to invoking innovative changes such as the implementation of advanced transportation technologies.

9.1. Implications for bureaucratic decision-making

Bureaucratic fleets do not recognize problems that are not monitored by the system and, therefore, will not likely be early adopters of AFV technologies, with two important exceptions:

government agencies and regulated utilities. Bureaucratic decision-making fleets belonging to these two types of organizations (53% of all utility fleets and 54% of all local government agencies in this study had bureaucratic decision-making fleets) have been and will likely continue to be the first purchasers of AFVs (CEC, 1992; Davis, 1995; DOE, 1993; Hu and Wang, 1996; Hu et al., 1996; NAFA, annual; Runzheimer, 1995; Vyas and Wang, 1999). Government fleets will continue to purchase AFVs at an increasing rate because: (1) many are specifically targeted by legislative directives that mandate them to use AFVs; and (2) public fleets are subject to much public scrutiny. Our mail survey found that 36% of the responding local government fleets were “likely” to acquire an alternative fuel vehicle “within the next year or two” (28% already had at least one AFV) compared to 8.9% of the business fleets.

Despite being in the public eye, or perhaps because they are, government fleet operators are least concerned about the short-term economic burden that may accompany a switch to AFVs. Although sensitive to saving taxpayers money, savings from shrewd fleet operations usually get returned to a general fund. Fleet operators are aware that because of shrinking budgets, fleet appropriations may be smaller the following year if the current allocation is not completely exhausted. This budgetary arrangement coupled with AFV purchase mandates will help maintain the government’s role as a leader in the AFV fleet market.

On the other hand, the decision by non-government fleets to investigate AFVs will likely be reactive and pursued only if it provides a solution to a problem or to crises monitored by the system. Implementation of AFVs will likely be incremental and occur only to the extent that it eradicates the problem at hand, rather than constituting a forward-looking proactive step towards a long-term commitment. Bureaucratic decision-making fleets will likely adopt the AFV solution that results in minimum departure from the existing state. We hypothesize that non-government fleets with bureaucratic decision structures will purchase only as many AFVs as required and will favor those vehicles that require the least amount of change.

In summary, the existence of firm and clear government rules tends to override a bureaucratic fleet’s tendency to follow a slow and veto-prone decision process – especially in the case of fleets operated by governments, regulated companies, and companies with vested interests. Thus, this subset of bureaucratic fleets is likely to be most responsive to mandates – probably far more responsive than to incentives and incentive-based regulations.

10. Hierarchic decision-making structure

Hierarchic decision-making structures, found in 33% of the fleets surveyed in this study, are most common in highly-departmentalized organizations with medium to large fleets. While the majority (67%) of hierarchic fleets in our survey reported having a central headquarters, individual sites are slightly more autonomous than bureaucratic fleets. Of those fleets that have a central headquarters, 45% retain sole responsibility for their own fleet decisions, while the rest rely on directives from headquarters.

Hierarchic decision-making fleets share characteristics with both autocratic and bureaucratic fleets. They are highly centralized and very formalized. Decisions are made by only one or two upper level managers but are guided by policies and standard procedures. The hierarchic fleet decision behavior is more sophisticated than autocratic fleets but less so than bureaucratic fleets.

Detailed cost analysis is used in major fleet decisions; especially if the costs are substantial, a large number of vehicles are affected, or precedence is being set. Nearly all hierarchic fleets either conduct an in-depth analytical assessment of the alternatives or make selections through the solicitation of bids (most do both). In most cases, authorization is required but, unlike the bureaucratic fleet process, the authorization is often a “rubber stamp” formality.

Major fleet decisions are made at the top of the organization although they may be initiated anywhere within the organizational hierarchy. Those who make fleet policy are not necessarily familiar with day-to-day fleet activities; they rely on a large support system for information, of which fleet managers are often an integral part. Other departments may provide feedback or expertise on such issues as safety, training, public relations, and legal ramifications. Committees are often formed to investigate the need for action and recommend possible solutions.

In most cases, relevant information is sent up the chain of command where it is acted upon and then sent back down for implementation. For instance, an organization’s environmental division may realize a need to purchase AFVs in order to comply with a new fleet rule. This fact is eventually conveyed up to the vice-president level for action. The fleet decision made at the vice-president level may concern how much money should be allocated for procuring AFVs; at the management level, which AFVs to buy; and at the fleet level, how the AFVs are to be used.

Hierarchic fleets differ from bureaucratic fleets in that they tend to be more capable of recognizing problems that do not fit within the existing decision-making structure; and thus they are less inclined to try to force decision issues to conform to standard procedures. In fact, there is some evidence that decisions which do not fit existing procedures and for which there is no precedent can be quickly elevated to the top levels of management (Hickson et al., 1986). The complexity and novelty of the AFV decision could propel it to the top of the organization and thus streamline the decision process.

The hierarchic fleet decision-making structure is prevalent in organizations which have several semi-autonomous fleets affiliated with different departments. For example, the marketing department may operate a fleet of luxury cars for entertaining clients; the sales division a fleet of economy cars because of large travel demands; and the service department a fleet of vans for carrying equipment. Usually the vehicles in these sub-fleets are stored and maintained at the same location. While each department has control over their own vehicles, one or two individuals who oversee the entire fleet operation make most critical decisions.

10.1. Implications for hierarchic decision-making

Unlike bureaucratic structures, hierarchic fleets are not overly reliant on rules, regulations or computational analysis; and unlike autocratic structures, they are not highly dependent on the judgment of a single individual. The decision process encompasses both non-quantitative factors and analytical evaluation. This situation represents the best circumstances for adopting AFVs with attributes that appeal to both fiscally-minded fleet managers and image-conscious executives.

Hierarchic decision structures are also prominent in large fleets with diverse travel needs. Inherent to this type of fleet composition is the ability to substitute vehicles and re-arrange schedules in order to accommodate various AFV attributes and limitations. This versatility makes hierarchic fleets good candidates for AFVs with operating restrictions (e.g., limited ranges). Intra-fleet vehicle substitution can significantly increase the number of potential AFV purchases. One study

found that substitution dramatically increases the number of electric vehicles (with a 60-mile range) that can potentially be used by fleets (Berg, 1984). More recent survey results indicate that 40% of fleets could readily substitute conventional vehicles for alternative fuel vehicles in cases where extra range is needed (CALSTART, 1999).

Hierarchic fleets will likely engage in proactive decision behavior with an emphasis on long-term solutions. Decision factors will include non-economic considerations as well as rigid analyses. In some cases, corporate image benefits may provide the necessary impetus for purchasing AFVs. Such considerations bear on decisions made at the higher levels of an organization where the AFV issue will be shaped. Hierarchic fleets are the most likely to leapfrog over near-term transitional options in favor of more promising long-term alternatives. They also have the ability to make and implement decisions expeditiously and, because decisions are not necessarily implemented uniformly (as with bureaucratic fleets), the inability of a single fleet site (or department) to use a particular vehicle type will not jeopardize the entire AFV program.

In summary, these organizations are most likely to make reasoned choices, taking into consideration strategic interests as well as carefully calculated costs. As a result, they will likely be most deliberately resistant to government mandates when those mandates do not coincide with the organization's preferred vehicle choices – even pursuing evasive behavior (such as shifting vehicles geographically). But they will also be most responsive to incentives, not only to those that reduce vehicle purchase costs but also to those that reduce operating costs.

11. Democratic decision-making structure

Fleets with democratic decision-making structures are relatively small and often belong to small organically structured organizations. Comprising only 5% of the survey respondents in this study, democratic fleets are the least common fleet type.

Democratic decision-making is highly decentralized and very informal. It is a “diffuse” process that involves several individuals at different organizational levels, departments, and sometimes even geographic locations (Connolly, 1977; Shumway et al., 1975). No individual is in a position to single-handedly commit the organization to a particular course of action. Technical knowledge, management savvy, and administrative experience come from several individuals who all influence the decision outcome. Although one individual may ultimately be held responsible for the decision, there is no single decision-maker, *per se*.

Competing interests often create a situation, where one member can be satisfied only at the expense of another. In these situations, the decision group essentially acts as a “political coalition”, where conflicts are resolved through bargaining and compromise (Cyert and March, 1963). Solutions seldom reflect the preferences of any one coalition member and the decision groups themselves tend to be transitory, changing with decisions (Cyert and March, 1959). In order to resolve problems in a reasonable time frame, the coalition does not engage in “optimizing behavior” but rather accepts the first alternative acceptable to all members (Tosi, 1975). Each member of the decision-group is presumed competent to contribute to the solution by virtue of his or her training and no single member can outvote or override the judgment of other members (Connolly, 1977). In the democratic structure, decision-making power is distributed equally among the participants, regardless of their position in the organization.

An organization may form an ad hoc committee to deal with a problem or it may simply seek a quorum of those most affected by the issue. Thompson and Tuden (1987) argue that such decision units can reach solutions using four different strategies – computation, judgment, compromise, or inspiration. A computational strategy is a technical assessment of the problem appropriate when actions and consequences are well-understood; a collective judgment (e.g., majority vote) is used when there is no consensus regarding causation; decision by compromise (achieved through bargaining and political maneuvering) is necessary when there is disagreement about possible outcomes; and when disagreement about both causation and outcome prevails, “inspiration” is required (which usually results in avoiding the issue completely).

Often the aims of one decision-maker directly conflict with those of another because their objectives are closely tied to the goals of their respective departments (Tosi, 1975). Decision-makers also use their position to gain power or political leverage for the next decision, which may be more important to them. As information is obtained each decision-maker may distort, filter, and edit it to suit his/her own needs. This gamesmanship, used to “enhance or protect one’s self-interest” (Allen et al. 1979), often leads to inter-group conflict and delay tactics.

Real or perceived knowledge of the decision issue is the most effective means of empowerment; therefore, individuals with the greatest vested interest generally become the most knowledgeable on the subject (Pfeffer, 1981). This gives them considerable leverage in the decision process. Individuals with the greatest knowledge of the situation are usually the most successful at co-opting other coalition members (Pfeffer, 1981). This is especially true in the initial stages when coalition members are sometimes confused, undecided, or perhaps even indifferent. A forceful advocate at the start of the decision process is often the most critical factor in determining the eventual outcome (Fahey, 1981).

Democratic decision structures favor simple solutions or sometimes avoiding a decision altogether. A cost analysis is seldom conducted and, if so, usually as a means of persuasion in the negotiation process, to gain time in an atmosphere of indecision, or for a posteriori justification of a decision already made (Bower, 1970; Hickson et al., 1986; Langley, 1990). Searches for viable solutions are usually conducted at the individual level and are cursory. Seldom do those solutions require any major “design” changes. The final choice is usually a compromise that is satisfactory to all coalition members but preferred by none. Although the democratic decision-making structure is widely recognized (Mintzberg, 1979; Pfeffer, 1981; Shrivastava and Grant, 1985), it is the most difficult to define because of its dynamic and unstable nature.

11.1. Implications for democratic decision-making

Democratic decision-making fleets present an interesting case for alternative fuel vehicles. Initiatives to purchase AFVs could start at the bottom of the organization in this decision environment where opinions of subordinates are weighed heavily. If the decision is initiated at the lower levels, then the proposal may have to be sold to individuals one at a time up the organizational hierarchy. This will likely require an “idea champion” (Daft, 1992) within the organization who would first have to recognize the solution and then convince others of its merits. Often with new equipment purchases, the individual who has the most contact with outside information sources and who is most involved in acquiring and communicating this information is the most influential in the decision process (Pfeffer and Salancik, 1978).

However, just as one individual can carry the AFV issue up to the top of the organization in this decision structure, so too can one individual keep it from being resolved. Again this individual could be a low-level employee looking out for his/her best interest as opposed to promoting ideas that benefit the organization. For instance, a mechanic who is uncomfortable working on a particular type of AFV could be very effective at persuading other decision-makers to dismiss that AFV from the solution set. This is especially true if the mechanic is perceived to be the most knowledgeable about alternative fuel vehicles.

The democratic decision structure is conducive to early recognition and diagnosis of the AFV issue due to the fact that many individuals throughout the organization have the power to initiate decision action.

However, the dynamics of group decision-making usually result in long delays and little action. Internal conflicts and competing interests inherent to democratic fleet structures are not conducive to reaching optimal solutions, especially in a timely manner. The final AFV solution will not likely be anyone's first choice but rather a compromise that meets with the least resistance and results in minimal change. Consequently, democratic fleets will not likely be the first to enter the AFV market.

Organizations with democratic fleets could benefit significantly from measures that educate and inform. AFV fleet decisions will likely be influenced most by the individual perceived to be most knowledgeable about the issue. However, biases can distort facts and incomplete knowledge can lead to uninformed decisions. Exposing other decision team members to AFV attributes and options will likely lead to more optimized resolutions. Unfortunately, even those expected to know about AFVs often fall short of conveying the information thoroughly and effectively. In a recent US survey, slightly more than half the fleets that purchased an AFV said the dealer failed to provide complete product information (CALSTART, 1999). Nearly the same percentage stated that the AFV dealer was not knowledgeable about the product.

12. Conclusions

Vehicle fleets are a poorly understood part of the economy. They are important, though, in that they purchase a large share of light-duty vehicles (1/4 in US and even more in other countries), and are often targeted by governments as agents of change. Based on extensive interviews, focus groups, and mail and telephone surveys in California, fleets were categorized into four groups based on their decision-making approaches and processes.

Least common were autocratic and democratic decision-making structures, representing 10% and 5% of the surveyed fleets, respectively (they represent an even smaller proportion of the total fleet vehicles). However, because very small fleets were not captured in our survey, it is likely that autocratic fleets constitute a greater percentage of the total fleet sector. The decision-making styles are at opposite extremes in level of centralization, but both tend to have fewer vehicles than other types of fleets. Autocratic fleets tend not to analyze life-cycle costs, make purchase decisions based on purchase prices are less inclined to value public relations benefits, and are most susceptible to hearsay and rumor; democratic fleets, in contrast, are influenced by internal champions or obstructionists who tend to be lower in the organization but better informed and more broadly analytical.

Neither of these two fleet types will be leaders in responding to government mandates and incentives. Being smaller in size, they have limited resources. More importantly, though, autocratic organizations heavily weight purchase price in their decisions (which biases decisions away from new products) and are reluctant to be guinea pigs, while democratic fleets tend to be slow to act because of diffuse decision-making processes.

Effective strategies to increase acceptance of new products and vehicles in autocratic fleets include increased access to information, including “success” stories from other fleets and incentives targeted at purchase price. It is more difficult to identify broad strategies for democratic fleets because of their dynamic and unstable decision processes.

Our survey results indicate that bureaucratic fleets could comprise close to 1/2 the total fleet sector (when including state and federal government fleets, which were not included in our survey). They follow a slow and veto-prone decision process – with important exceptions. The existence of firm and clear government rules tend to override a bureaucratic fleet’s otherwise ponderous decision-making process, especially in the case of fleets operated by governments, regulated companies, and companies with vested interests. Thus, a subset of bureaucratic fleets is likely to be responsive to mandates – probably far more so than to incentives and incentive-based regulations. Bureaucratic fleets not operated by government will likely not be responsive to either government rules or incentives.

Hierarchic fleets, accounting for approximately 1/3 of all fleets and a disproportionately large share of vehicles, are most likely to make reasoned choices, incorporating both life-cycle cost analysis and larger strategic interests into the decision process. As a result, these fleets will likely be most deliberately resistant to government mandates when those mandates do not coincide with the organization’s preferred vehicle choices – even pursuing avoidance behavior, such as shifting vehicles between geographic offices. But they will also be most responsive to incentives, not only to those that reduce vehicle purchase costs but also to those that reduce operating costs.

The diversity of fleet behaviors is especially pronounced during the early years of new product launches. But once a particular AFV (or other product or service) is successfully incorporated into the fleet, the subsequent purchase will generally become more streamlined. Eventually, the purchase may become a routine procedure much like the purchase of a conventional vehicle or service. The first AFV that works satisfactorily, be it an electric, hybrid, natural gas, or alcohol fuel vehicle may become, by default, the preferred AFV for future purchases by that fleet. Fleet operators, like most individuals, adhere to solutions that are successful. This is especially true as organizations become heavily invested in a particular product, for instance through specialized refueling or maintenance facilities.

Good policy requires a sophisticated understanding of affected behaviors; policy is more effective and efficient when formulated in anticipation of expected behavior. The rate of change and rate of responsiveness will, of course, be influenced by political urgency. While we did not address political urgency, our findings should hold whether policy initiatives have strong or weak political support. If public support for new initiatives is weak, as has been the case with AFV purchase requirements, then government rulemaking will be slow, enforcement weak, and subsidies fleeting. In any case, to be effective, government initiatives must recognize which fleets will be most responsive to which types of initiatives. This paper provides a framework and suggestions for how to design those initiatives.

References

- AGA/NGVC. 1991. Natural gas vehicle fleet market study. The American Gas Association and the Natural Gas Vehicle Coalition (prepared by Easton Consultants).
- Allen, R.W., Madison, D.L., Porter, L.W., Renwick, P.A., Mayes, B.T., 1979. Organizational politics: tactics and characteristics of its actors. *California Management Review* 22, pp. 77–83.
- Allison, G.T., 1971. *Essence of Decision*. Little Brown, Boston.
- Berg, M., 1984. Electric vehicles in commercial sector applications: a study of market potential and vehicle requirements. Prepared for the Electric Power Research Institute, Institute for Social Research, University of Michigan.
- Berg, M., 1985. The potential market for electric vehicles: results from a national survey of commercial fleet operators. *Transportation Research Record* 1049, 70–78.
- Bobit (annual). *Automotive Fleet: Fact Book*, Bobit Publishing, Redondo Beach.
- Bower, J.L., 1970. *Managing the resource allocation process: a study of corporate planning and investment*. Division of Research. Harvard Business School, Boston.
- CALSTART, 1999. 1995 and 1999 Fleet operator survey results: an evaluation and analysis of fleet needs and concerns about alternative fuel vehicles. Pasadens, CA.
- CEC, 1992. *Local Government Fleet Survey Results*. California Energy Commission, Sacramento.
- Chaudier, A., 1989. *Runzheimer International The Runzheimer Guide to Fleet Management*, Northbrook.
- Connolly, T., 1977. Information processing and decision making in organizations. In: *New Directions in Organizational Behavior*, St. Clair Press, Chicago.
- Cyert, R.M., March, J.G., 1959. A behavioral theory of organizational objectives. In: Haire, M. (Ed.), *Modern Organization Theory*, Wiley, New York.
- Cyert, R.M., March, J.G., 1963. *A Behavioral Theory of the Firm*. Prentice-Hall, Englewood Cliffs.
- Daft, R.L., 1992. *Organization Theory and Design*. West Publishing Company, St. Paul.
- Davis, S.C., 1995. *Transportation Energy Data Book*, 15th edition, Oak Ridge National Laboratory, Oak Ridge.
- DOE, 1993. *First Interim Report of the Federal Fleet Conversion Task Force*. Office of Scientific and Technical Information, Oak Ridge.
- EPA, 1991. *Estimated Number of Fleet Vehicles Affected by the Clean Fuel Fleet Program*. Docket A-91-25, Ann Arbor.
- ETFUCTI, 1990. *Fleet Assessment for Opportunities to Effectively Deploy Light Duty Alternative Fuel Vehicles*. Energy Task Force of Urban Consortium for Technology Initiatives, Detroit.
- Fahey, L., 1981. On strategic management decision processes. *Strategic Management Journal* 2, pp. 43–66.
- FHWA, 1992. *Summary of Travel Trends: 1990 Nationwide Personal Transportation Survey*. Federal Highway Administration, Washington, DC.
- Fredrickson, J.W., 1986. The strategic decision process and organizational structure. *Academy of Management Review* 11 (2), 280–297.
- Golob, T.F., Torous, J., Bradley, M., Brownstone, D., Crane, S.S., Bunch, D.S., 1997. Commercial fleet demand for alternative-fuel vehicles in California. *Transportation Research* 31 (3), 219–233.
- Hickson, D.J., Butler, R.J., Cray, D., Mallory, G.R., Wilson, D.C., 1986. *Top Decisions: Strategic Decision-Making in Organizations*. Basil Blackwell, Oxford.
- Hu, P.S., Wang, M.Q., 1996. State vehicle fleets and their potential acquisition of alternative fueled vehicles under EPart 507. *Transportation Research Record* 1520, 140–146.
- Hu, P.S., Wang, M.Q., Vyas, A., Mintz, M., Davis, S.C., 1996. Potential coverage of alternative fuel industries under EPart Section 501. *Transportation Research Record* 1520, 147–155.
- Inkson, J.H.K., Pugh, D.S., Hickson, D.J., 1970. Organisation, context and structure: an abbreviated replication. *Administrative Science Quarterly*, pp. 318–329.
- James, L.R., Jones, A.P., 1976. Organizational structure: a review of structural dimensions and their conceptual relationships with individual attitudes and behavior. *Organizational Behavior and Human Performance* 16, 74–113.
- Kleindorfer, P.R., Kunreuther, H.C., Schoemaker, P.J., 1993. *Decision Sciences: An Integrative Perspective*. Cambridge University Press, Cambridge.

- LADWP/SCE, 1989. Electric Vehicle Los Angeles Area Market Analysis Fleet Study. 79170, Los Angeles Department of Water and Power, Southern California Edison.
- Langley, A., 1990. Patterns in the Use of Formal Analysis in Strategic Decisions. *Organization Studies* (November), 17–45.
- Mader, J., Brunner, J., Bevilacqua, O., 1988. Electric vehicle commercialization. The Ninth International Electric Vehicle Symposium, Toronto, EVS88-P10.
- March, J.G., Shapira, Z., 1992. Behavioral decision theory and organizational decision theory. In: Zey, M. (Ed.), *Decision Making: Alternatives to Rational Choice Models*. Sage Publications, Newbury Park, 273–303.
- March, J., Simon, H., 1958. *Organizations*. Wiley, New York.
- Miau, S.P., Hu, P.S., Young, J.R., 1992. Fleet vehicles in the United States: Composition, operating characteristics, and Fueling Practices. ORNL-6717, Oak Ridge National Laboratory, Oak Ridge.
- Mintzberg, H., 1979. *The Structuring of Organizations*. Prentice-Hall, Englewood Cliffs.
- Mintzberg, H., Raisinghani, D., Theoret, A., 1976. The structure of unstructured decision processes. *Administrative Science Quarterly* 21 (2), 246–275.
- Moser, M., Andrae, A., 1998. Fleet managers and decision makers: Characteristics and demands in relation with the deployment of alternative drive line systems and motor fuels. Results of the MATADOR survey. Austrian Mobility Research, No. JOE3-CT97-0081, Graz, Austria.
- NAFA (annual). NAFA's New Vehicle Acquisition Survey Results. National Association of Fleet Administrators, Fleet Executive.
- Nesbitt, K., Sperling, D., 1998. Myths regarding alternative fuel vehicles demand by light-duty vehicle fleets. *Transportation Research – D* 3 (4), 259–269.
- Nesbitt, K.A., 1996. An organizational approach to understanding the incorporation of innovative technologies into the fleet vehicle market with direct application to alternative fuel vehicles. Institute of Transportation Studies, UCD-ITS-RR-96-9, Ph.D. dissertation, University of California, Davis.
- Pfeffer, J., 1981. *Power in Organizations*. Pitman Publishing, Marshfield.
- Pfeffer, J., Salancik, G., 1978. *The External Control of Organizations: A Resource Dependence Perspective*. Harper and Row Publishers, New York.
- Pugh, D.S., Hickson, D.F., Hinings, C.R., Hinings, C.T., 1968. Dimensions of organization structure. *Administrative Science Quarterly* 13 (June), 65–105.
- Pugh, D.S., Hickson, D.J., Hinings, C.R., 1969. An empirical taxonomy of structures of work organizations. *Administrative Science Quarterly* 1969a, 115–126.
- Quinn, J.B., 1980. *Strategies for Change: Logical Incrementalism*. Richard D. Irwin, Homewood, IL.
- Runzheimer, I., 1991. *Survey and Analysis of Business Car Policies and Costs 1991–1992*. Runzheimer International, Rochester.
- Runzheimer, I., 1993. *Survey and Analysis of Business Car Policies and Costs, Tenth ed.*, Runzheimer International, Rochester.
- Runzheimer, I., 1995. *Special Summary Report: 1994 AFV Strategist Survey*. Runzheimer International, Rochester.
- SCGC, 1990. *Vehicle Fleet Managers Survey: Characteristics of Vehicle Fleets and Alternative Fuel Usage and Preferences*. Southern California Gas Company.
- SDG&E, 1992. *SDG&E Electric and Natural Gas Market Study*. San Diego Gas and Electric Company.
- Shonka, D., 1980. *An Analysis of the NAFA Fleet Data Base: Passenger Cars Only*. BNL 51301, Brookhaven National Laboratory, Upton, New York.
- Shrivastava, P., Grant, J.H., 1985. Empirically derived models of strategic decision-making processes. *Strategic Management Journal* 6, 97–113.
- Shumway, C.R., Maher, P.M., Baker, M.R., Souder, W.E., Rubenstein, A.H., Gallant, A.R., 1975. Diffuse decision-making in hierarchical organizations: an empirical examination. *Management Science* 21 (6), 697–707.
- Sperling, D., 1995. *Future Drive: Electric Vehicles and Sustainable Transportation*. Island Press, Washington, DC.
- Steinbruner, J.D., 1974. *The Cybernetic Theory of Decision*. Princeton University Press, Princeton.
- Thompson, J.D., Tuden, A., 1987. Strategies, structures, and processes of organizational decision. In: Brief, A.P. (Ed.), *Comparative Studies in Administration, Management, and Technology*, Garland Publishing, New York, p. 224.
- Tosi, H.L., 1975. *Theories of Organizations*. St. Clair Press, Chicago.

- UIG, 1985. Vehicle Fleets in the South Coast Basin: Results of a Survey Performed for the South Coast Air Quality Management District. Urban Innovations Group, Los Angeles.
- Vyas, A.D., Wang, M., 1996. Potential impacts of the energy policy act on electricity and natural gas provider fleets. *Transportation Research Record* 1520, 156–163.
- Wagner, J.R., 1979. Vehicle attributes constraining EV applicability in fleets. BNL 51099, Brookhaven National Laboratory, Upton, New York.
- Wagner, J.R., 1980. A method for estimating technological penetration rates in commercial automobile fleets. BNL 51312, Brookhaven National Laboratory, New York.