EVALUATION OF INNOVATIVENESS AS A FACTOR IN THE ADOPTION OF ENERGY EFFICIENT HOUSING ALTERNATIVES

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CHAPTER I

INTRODUCTION

Since the Arab oil embargo in 1973-74, Americans have experienced spiraling increases in the cost of household utilities. It is predicted that high energy costs are not likely to be abated (Hirst, 1980; National Research Council, 1980; Schipper and Ketoff, 1983). If these predictions are true, the era of an abundant and inexpensive energy supply has come to a halt during the period in American history when its people have become accustomed to an energy intensive lifestyle.

Fifty percent of the energy consumed in the United States is for space heating purposes (Miller, 1982; Shama, 1983). Previous research suggests energy consumption would be less if American buildings and homes were better designed, oriented, insulated and lighted (Meyer, 1983; Miller, 1982; Stobaugh and Yergin, 1980). Estimates of energy savings range from 50 to 90 percent if architects, designers and developers took just these four factors into account (Miller, 1982).

Technological advancements in housing have occurred which offer consumers alternatives to energy intensive housing types. Two such dwelling choices have been built

throughout the United States during the past decade and monitored to determine energy usage: solar and earth sheltered homes (Shama, 1983; Sterling, 1980). Study findings indicate a substantial reduction in the dependence on a fossil fuel supply, yet the overall adoption rate of these energy efficient housing alternatives has been slow (Shama, 1983; Sterling, 1980). Of primary interest to this study were those Oklahoma families living in solar or earth sheltered homes during the spring of 1983.

Growing numbers of researchers, primarily with a background in marketing, education, communication, rural sociology or medical sociology, have chosen to examine how a technical innovation or idea was introduced and diffused into society (Rogers, 1983; Shama, 1983). The work of Rogers and Shoemaker (1971) suggests the decision to accept or reject an innovation is based upon an individual's attitude toward the object in question. Ajzen and Fishbein (1982) developed a conceptual model that examined the attitude-behavior relationship under conditions in which the attitudes and behavior covary and found a person's attitudes toward a behavior were based upon the desired evaluation of the outcome. Researchers at Columbia University studying the interpersonal communication networks among physicians found early adopters did influence the adoption rate of new drug products by their peers. Similarly, Lewin (1965) reported social influences or group consensus were highly correlated with the degree to which an innovation is

adopted.

In an extensive review of the diffusion literature, Rogers (1983) concluded that the rate of adoption of a given innovation by individuals within a society, was affected by its relative advantage, complexity, trialability, compatability and communicability. As such, the adoption of innovations is considered to be: 1. proportionate to the degree to which it is seen as superior to that which it is to supercede; 2. easy to comprehend and apply; 3. capable of being tried on a limited basis; 4. consistent with the cultural norms of a society; and 5. dependent upon the ease with which the innovation can be observed and communicated to potential adopters. Rogers (1983) also proposed a series of ideal adopter categories based upon the length of time between the awareness of an innovation and the actual adoption of that innovation by an individual. The identified adopter categories and characteristics assigned to each by Rogers (1983) are as follows:

1. INNOVATORS: The first to adopt tend to be young venturesome individuals who are willing to take risks, have a high degree of exposure to the outside world, are of high socioeconomic status, are well educated and are able to understand complex technical knowledge.
2. EARLY ADOPTERS: Looked upon as leaders by

their peers, these individuals are respected and fully integrated in community and inter-community social networks.

3. EARLY MAJORITY: These individuals are less likely to be leaders in their community and will carefully consider the consequences of adopting an innovation prior to acceptance.
4. LATE MAJORITY: These individuals tend to be more skeptical of an innovation with peer pressure often necessary before they will adopt a new idea or product...and as such, adoption will take place just after the "average" member of a society.
5. LAGGARDS: These are the traditional members of a society who are openly conservative, prefer the status quo and tend to be suspicious of any kind of change.

While the diffusion research tradition has continued through worldwide empirical investigations, little research has been done to date which examine individual characteristics and the degree of innovativeness of those presently living in energy efficient alternative housing types, i.e., active solar, passive solar and earth sheltered dwellings. Such research would be helpful in identifying those elements influencing the adoption process.

Statement of the Problem

The adoption rate for energy efficient alternative housing types has been slow although there has been an abundance of information available to American consumers regarding the energy problem and the continued possibility of soaring utility rates (Shama, 1983). If a reduction in the dependence upon fossil fuel supplies is to be achieved in this country, an empirical investigation of the personal characteristics and attitudes of people now living in an innovative housing type would bring a better understanding of the adoption process.

Purpose and Objectives

The purpose of this study was to develop an instrument which would examine five aspects identified in the literature as measuring an innovative attitude. They are: 1. the demographic characteristics; 2. information sources used (communication channels); 3. one's perception of a problem (in this instance, an energy problem); 4. one's leadership role in the community; and 5. the perceived attributes of the innovation itself. Figure 1 presents in model form the variables under consideration in this study.

Two groups of households were chosen for this study. The first group contained those people living in homes that are categorized for this study as energy efficient housing alternatives, namely, solar and earth sheltered dwellings.

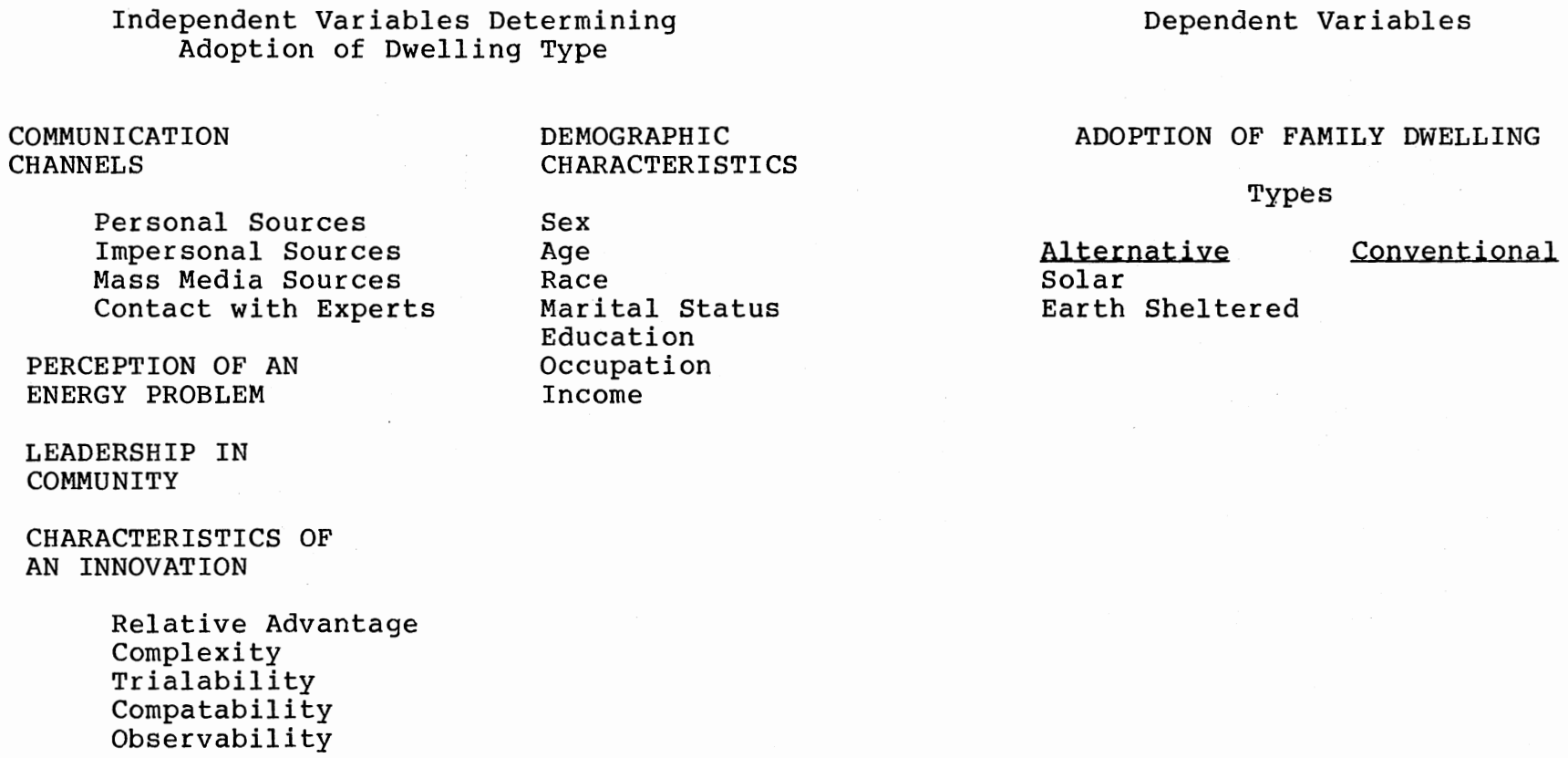


Figure 1. Dependent and Independent Variables Used in This Study. Adapted from Figure 6-1, Paradigm of Variables Determining the Rate of Adoption of Innovations, by Everett M. Rogers, DIFFUSION OF INNOVATIONS, 3rd Edition, New York Free Press, 1983, p. 233. Reprinted by permission.

A second group was used for comparative purposes and was comprised of conventional home dwellers.

The following objectives will be used for this study:

1. to develop an instrument that measures an innovative attitude among people living in solar, earth sheltered, and conventional dwellings;
2. to assess the similarities and differences in an innovative attitude and selected variables among solar, earth sheltered, and conventional home dwellers;
3. to ascertain which demographic variables contribute to an innovative attitude and selected variables among people living in solar, earth sheltered, and conventional dwellings;
4. to develop an information base that will be useful to housing professionals.

Research Questions

1. Is there a difference in innovative attitudes or related sub-factor dimensions among people living in solar, earth sheltered, or conventional dwelling types?
2. What is the relationship between the demographic variables sex, age, race, marital status, education and income levels, and occupational status and an innovative attitude among people living in solar, earth sheltered, or conventional dwelling types?

Assumptions

For this study, the following assumptions are being made:

1. Individuals who complete a questionnaire will respond honestly to the questions being asked of them.
2. The variables selected to measure an individual's degree of innovativeness are sufficient for that purpose.
3. The research sample will adequately represent the population from which it was drawn.

Limitations

The limitations of this study are:

1. The geographic location of dwellings is confined to the State of Oklahoma.
2. Although respondents will be selected based upon their living in one of the specific dwelling types under consideration in this study, differences may exist in terms of housing size and demographic characteristics.
3. There will be a census sample of solar and earth sheltered homes but a matched sample of conventional homes based upon the geographic location of the alternative housing types.

Definition of Terms and Concepts

The following terms are used in this study:

ACTIVE SOLAR HOME: A housing unit using active solar heating systems would commonly consist of solar collection panels plus a storage medium to hold the heat collected during the day and a set of automatic controls that monitor and regulate both heat collection and delivery between the storage medium and the living space.

ALTERNATIVE HOMES: For this study, "Alternative Homes" will include passive solar, active solar and earth sheltered dwellings.

COMMUNICABILITY: An individual's willingness to seek or give advice and information to others.

COMMUNICATION CHANNELS: The personal and impersonal sources of information used by an individual.

COMMUNITY NORM: The degree to which an individual conforms to group influence or expectations (Rogers, 1983).

COMPATABILITY: The degree to which an innovation is consistent with the needs, values and experiences of potential adoptors (Rogers, 1983).

COMPLEXITY: The relative degree to which an innovation is difficult to understand or use (Shama, 1982).

CONVENTIONAL HOME: A housing unit designed for one family surrounded on all four sides by land and built using standard construction techniques.

EARTH SHELTERED HOME: A housing unit in which a mass of earth has been deliberately placed in contact with the structure in order "to benefit the environment of a

habitable space. These benefits may be ecological, aesthetic, economic or related to land use" (Underground Space Center, 1982, p. 3).

INNOVATIVENESS: The degree to which an individual is willing to accept a new idea or product "relatively earlier than others" (Rogers and Havens, 1962, p. 35).

LEADERSHIP IN THE COMMUNITY: The degree to which an individual actively participates in national or local organizations and activities and whose opinions are sought by others.

OBSERVABILITY: The degree to which an innovation is observed and communicated to others (Rogers, 1983).

PASSIVE SOLAR HOME: A passive solar system operates on normal physical forces such as thermal convection, wind, gravity, and other natural physical phenomena, without utilizing any auxiliary power for distribution or operation of the system.

PERCEPTION: An individual's selection, organization and interpretation of a specific situation that is based upon the prior learning or experiences of that individual (Theodorson, 1969).

RELATIVE ADVANTAGE: The degree to which an innovation is superior to the one it supersedes (i.e., reduced costs or maintenance) (Rogers, 1983).

SOCIAL STATUS: An individual's position in the social structure. For this study, one's position of social status will be indicated by respondent's income,

occupation, education, and position of leadership within the community (Rogers, 1983).

TRIALABILITY: The extent to which an innovation can be experimented with on a limited basis (Rogers, 1983).

Summary

As complex as the current energy situation may be, the overriding factor of high utility costs has made the American public aware of their dependence on finite energy supplies. The challenge we now face is to make the transition from an energy-intensive lifestyle to one that would use less of the earth's natural resources. Because space heating accounts for the major portion of energy used in the home, energy efficient alternative housing types have been developed. It was the purpose of this study to examine the degree of innovativeness by individuals presently living in two such housing alternatives, i.e., solar and earth sheltered homes, in order to identify those factors that influence the adoption process.

CHAPTER II

REVIEW OF LITERATURE

A review of literature addressing the objectives and research questions outlined in Chapter I is included in this chapter. The literature has information which: 1. examines major issues related to the energy situation in the United States; 2. describes energy efficient housing alternatives included in this study; 3. describes the process involved in the diffusion of an innovation; and 4. examines the need for the adoption of more energy efficient housing based upon finite fossil fuel supplies and rising energy costs.

The Energy Problem: No Easy Answers

The energy situation that has developed in the United States is the result of a multitude of factors including an increasing population, an abundant supply of low-cost fossil fuels and an energy-intensive lifestyle. Until the Arab oil embargo in 1973, Americans gave little thought to the amount of energy they used each day. Convenience, speed and comfort had become a way of life. Suddenly there was a problem that had the potential of becoming a true crisis. To understand how the United States could be placed in this

position, an understanding of its energy history is necessary.

Prior to and during World War II, the American economy was based primarily on its vast supplies of coal. Coal was used for industrial production, to power ships and railroads, to generate electricity and as a heat source in residential and commercial buildings. Gradually coal was replaced by oil and natural gas which were found to be easier to extract and transport, and cleaner to use. While 80 percent of America's total energy needs were supplied by coal in 1920, the percentage of the total dropped to 38 percent by 1950, and to 20 percent by 1973 (Federal Energy Administration, 1976-1977).

Oil and natural gas were plentiful and inexpensive during this period. Transportation systems and manufacturing processes were converted. The petrochemical industry began producing synthetic fibers, plastics, fertilizer and medicines. Commercial and residential buildings were built without regard to climatic conditions because of the new heating systems. The skyrocketing consumption rate coupled with an expanded population size placed greater and greater demands on domestic energy supplies (Stobaugh and Yergin, 1980).

With a combination of national supplies and low cost imports, the United States in 1955 was supplying two-thirds of the world's oil market in addition to meeting internal needs. But as early as 1948, Venezuelan crude oil was being

imported in quantities greater than the American exports. During the mid-1950's, the United States began to increase the volume of low-cost oil imported from the Middle Eastern countries as well (Stobaugh, 1980).

The peak of America's oil production occurred in 1970 and from that time forward, the United States has been dependent upon foreign imports to meet its daily requirements (Teller, 1979). By 1973, 37 percent of the American oil supplies were being imported (League of Women Voters, 1977). The amount from foreign sources increased to 43 percent by 1980, of which 85 percent was being supplied by the Mid-Eastern Organization of Petroleum Exporting Countries (OPEC) (Miller, 1982).

Not only does the dependence upon foreign oil supplies have far reaching effects on the American economy, but it also contributes to a lack of international bargaining power. When the Arab oil embargo occurred in late 1973 and 1974, the United States lacked the emergency reserves needed to be self sufficient for a period of time. When the embargo was lifted, the price of imported oil had increased 366 percent (American Petroleum Institute, 1979).

The costs of imported oil would remain somewhat stable through 1978, but during that period oil consumption rate in America grew by 1.5 million barrels per day (Stobaugh, 1980). Another dramatic price increase took place during the winter of 1978-1979 and oil imports jumped from a price

of $12-$13 a barrel to $30-$35 (Stobaugh and Yergin, 1980). Miller (1982, p. 257) reports a total of $82 billion dollars was spent on imported oil by the United States for "an average of a quarter of a billion dollars a day."

In addition to the staggering costs involved, a political instability in the OPEC countries has the potential of interrupting oil supplies destined for abroad. This leaves the United States vulnerable to political pressures and possibly blackmail (Anderer et al., 1981).

Realizing that one of the greatest producers and refiners of crude oil had also become the greatest consumer, President Carter's first energy program in 1977 emphasized two approaches for the United States to pursue: priority number one would be to conserve energy (Federal Energy Administration, 1977), and second would be to develop a synthetic fuel program (U.S. Congress, Senate, Energy Committee, 1977). Of the two, conservation of energy would help extend the supply of fossil fuels and thus provide some time to develop energy alternatives.

In its report to the Department of Energy, the National Research Council, Committee on Nuclear and Alternative Energy Systems (1980, p. 4) stressed again the need to reduce the dependence on oil imports and recommended adopting a policy of conservation as the "highest immediate priority in energy planning." The type of conservation effort the Committee felt offered "the greatest promise of substantially moderating the growth of energy consumption"

involved "replacing equipment and structures with those that are more energy efficient" (p. 11).

Some writers have stated that energy consumption would be less if American buildings and homes were better designed, oriented, insulated and lighted (Hirst, 1981; Meyer, 1983; Miller, 1982; Sullivan, 1980). In Kozak's (1981, p. 8) report on Congressional input during the development of the Energy Conservation Standards for New Buildings Act, he states a minimum of 40 percent of the energy consumed in homes built prior to 1976 was found to be "wasted because of inefficient building design and equipment." Clark (1979, p. 6) suggests the widespread adoption of energy efficient dwellings "would result in saving more than 1.25 million barrels of petroleum per day."

Presently, the availability of energy efficient homes is being helped by the energy conservation building codes now mandated in many states (Meyer, 1983). New building designs as well as construction techniques can work together to meet our housing needs and yet decrease energy consumption. Solar and earth sheltered homes are two dwelling types described in the literature as energy-conserving building designs which contribute to a decreased dependence on fossil fuel supplies (Meyer, 1983; Sterling, 1980).

Energy Efficient Housing Alternatives

Use of the Sun

To harness the sun's energy as an "appropriate technology" has been recently advocated by many as one solution to the dependence on non-renewable primary forms of energy supplies. This idea is based upon the premise that directly or indirectly, life on the planet earth is dependent upon the sun's energy for its very existence.

In his theory on the evolution of culture, White (1975) believed the first instance to harness solar energy for the benefit of human life was during the period when the cultivation of plants and domestication of animals was made possible. In architecture, the application of direct solar heating was used by the Romans for the Forum Baths in Ostia, Italy (near Rome, circa 250 A.D.). Their system used a combination of "under-floor and wall-channel heating flues around the rooms" (Watson, 1979, p. 4). As a weapon, solar reflecting mirrors were used by Archimedes in 212 B.C. to set the Roman fleet afire and again in 626 A.D. against Vitellius during the conflict in Constantinople (Clark, 1974). Centuries would pass before the benefits of solar energy would again be discovered and used. By the 19th century, mirrors were once more able to ignite fires, thanks to Athanasius Kirchher, a German inventor; and the LeSoloil newspaper in Paris, France was being printed on a press operating on a solar powered steam engine (Skurka and Naar,

1976).

The early use of solar energy in the United States can be seen in the Indian pueblos of the West and Southwest. In addition to a proper orientation toward the sun, the use of adobe as a building material would help keep the Indian dwellings cool in the summer and warm in the winter. During the first decade of the 20th century, solar water heaters were being produced in great quantities in California and Florida (Coe, 1979). Clark (1975, p. 7) states that during that period, the cost of natural gas was quite expensive and solar energy systems were "competitive with conventional fuels." These solar water heaters were used extensively in California and Florida through the 1930's. An estimated 50,000 such heaters were still in use in Miami, Florida in 1951 (Clark, 1975). By 1971, the solar industry had all but vanished in the United States. With the Arab oil embargo of 1973-1974, our dependence on a diminishing fossil fuel supply was recognized and the solar alternative would be seen as an inexhaustible, nonpolluting and "free" solution for the future (Sukura and Naar, 1976).

Although researchers have been investigating a wide range of solar energy applications since the 1940's, acceptance of the technology has met opposition in some arenas. It has been suggested that the "solar power era" did not materialize as quickly as it might have for a variety of reasons. One overriding factor was the price

charged for the solar products themselves. They were not cost effective when compared to the amount then being charged for fossil fuels. And until quite recently, the solar equipment available on the market for commercial use was not as dependable as it might have been (Shama, 1983). In addition, there was resistance from the government to fund research due to the pressures brought forth from the fossil fuel industries who stood firmly against any competition that might be forthcoming (Clark, 1975). Yet as early as 1952, President Truman's Materials Policy Commission recommended the development and use of solar energy as a means to meet future energy demands (Clark, 1975).

These deterrents did not stop many who were firmly convinced of the contributions solar energy could make to society as a whole. The development of solar space heating, air conditioning, and hot water heating systems by individuals continued, as did the progress in the conversion of the sun's rays to electricity via photovoltaic cells. Miller (1982, p. 334) reported that the solar energy "falling on the earth in only three days, if concentrated and converted to useable forms, would equal all of the earth's known reserves of coal, oil and natural gas." And this same amount would be "9,000 times the energy consumed in the world each day." The scientists, researchers and inventors would not forget the power within the sun's rays.

In some areas of the United States, entire communities

were developed using an energy-conscious land use plan along with building solar energy-saving residences (Bainbridge et al., 1979). Individual states began to revise their building codes to include prescriptive and performance standards for all new construction (Coe, 1979). Power towers (or solar furnaces) have been built in Sandia, New Mexico and Barsto, California to test the feasibility of computer-controlled mirrors which are used to focus the sun's rays on a steam boiler that then produces electricity (Miller, 1982). While the cost is still prohibitive, the development of photovoltaic cells for producing electricity has progressed to the point where at least one company is designing them in a nail-on shingle form for roof construction (Miller, 1982).

To help facilitate the growth of solar energy, the United States government began offering to consumers, solar tax credits on a percentage basis of a system's overall cost (Anderson, 1977). Many states quickly followed the national government's lead. Further support to the solar energy alternative was cited in the National Research Council's report (1979, p. 354), in which the Committee recommended "additional solar tax credits, low-interest or interest-free loans, thermal performance standards for buildings or additional taxes on nonrenewable fuels" to be implemented.

Evidence suggests that support must be found in the local governmental agencies. The Real Estate Research

Corporation found "local government officials in the building code department, tax assessor's office and the planning and zoning agency can encourage or inhibit the development" of solar homes (U.S. Department of Housing and Urban Development, 1981, p. ii). Hunt (1982) concurs, adding that the fragmented housing construction industry, by its very nature, can have little impact on agencies within the local government and often the restrictions will dampen the enthusiasm of a builder or homeowner wanting to include solar energy in the design of a house.

Regardless of the progress that is made in the many aspects of the solar field, support from financing institutions is critical. In the past, lenders have been slow to approve loans to those planning to build or purchase an alternative housing type (Scott, 1980). Any design that was out of the conventional norm or any mechanical system for the dwelling that was different, was considered a high-risk investment (Coe, 1979). Today, many lenders will hire an architect or engineer to review a plan for its soundness and have consultants evaluate the mechanical systems' performance and reliability. Once this phase is cleared, the question of resale value must be discussed and evaluated according to the practice of the individual lending institution. Those dwellings with limited appeal are not often approved for financing (Coe, 1979).

During the 20th century, many of the early design concepts which used the sun were discarded and ignored when

new technologies for heating, cooling and lighting homes were discovered (Watson, 1979). As a result, the homes built used increasing amounts of coal, oil or natural gas (Miller, 1982).

The use of solar energy to heat homes, heat water and power air conditioners has increased as a result of the rising costs in the energy supplied to American homes. The development of solar home technology has taken two paths, active and passive, with each method having the same four requirements: solar collection, storage, distribution and control. The two systems differ, however, in that an active system requires external mechanical devices to collect and distribute the heat collected while the passive system relies more upon a design approach to capture, store and distribute the sun's energy. Depending upon their design, these systems can provide 30 to 100 percent of the heating needs even in the coldest of climates (Mazria, 1979; Sersen, 1980).

Active Solar Dwellings

An active solar heating system uses mechanical components to collect and distribute radiant energy from the sun. Collectors are used to trap the sun's heat, an insulated water tank or rock bin to store it, and pipes or ducts are used to distribute it as needed. It is distinguished from a passive solar dwelling in that

thermostats, fans, pumps and valves are used to drive a heat transfer fluid or air from panels to storage through the distribution of heat throughout the home.

There are many different makes and models of active solar collectors in the marketplace, and they all work in basically the same manner. The difference will be found in the types of heat transfer medium used. Air, water, glycol, mineral oil, synthetic oil and silicone oil solar collectors are available to consumers. Hot-air systems usually have a rock storage container that is built above or below ground level. The warmed air is distributed from the storage container to the home as needed. In the collectors using a liquid medium, the heated fluid is first pumped to a heat exchanger where air is warmed and then distributed through a forced-air heating system.

The amount of solar heating collector panels needed is determined by the size of one's home and its orientation to the sun. The storage capacity of an active system provides heat for the home during long winter storms or cloudy periods when the lack of direct sun prevents heat build-up in the collectors and replacement of heat in storage. During prolonged periods of unfavorable weather, a conventional heating system or wood stove is often needed (Hunt, 1982).

A less complicated and usually smaller collector panel system is used in a solar hot water system. The hot water accumulated in the collector panels will flow directly to an

insulated water tank for home use. As with the active solar heating system, a back-up system is required for those periods when the sun does not shine for a few consecutive days (Meyer, 1983).

The active solar systems providing heat and domestic hot water have one major drawback: the initial cost of an active solar system today is very high when compared to that of a conventional one. And the cost effectiveness after installation will depend upon where it is built, how many sunny days there are, the temperature during the winter months and the local utility rates. For example, in Oklahoma, active solar domestic hot water systems and active solar swimming pool heating systems have been proven to be "economically viable," but at present, the active solar space heating systems are not (Williams and Larson, 1983, p. A-11). The difference may be in the amount of solar equipment necessary for heating one's home being "5 to 10 times" greater than that for generating hot water (Williams and Larson, 1983, p. A-22). However, the operating costs of conventional heating systems are expected to rise as the prices of dwindling nonrenewable energy resources increase. It is, therefore, expected that solar space heating systems will soon compare favorably with conventional systems (Hunt, 1982).

Passive Solar Dwellings

As previously stated, the passive solar home has four basic requirements: solar collection, storage, distribution and control which is obtained through a building's design. Common construction materials are used and the mechanical hardware seen in active solar systems are not necessary. Three passive heating systems exist: direct gain, indirect gain, and isolated gain with possibly a hybrid of these three systems (Sunset, 1979).

The direct gain home stores solar heat in thick, massive floors and walls of concrete, stone, brick, adobe, or water held in containers for use at night and during days when the sun does not shine (Skurka and Naar, 1978). The passive solar home will collect sunshine through large south facing windows to warm the living space directly. The solar heat is then distributed throughout the home mainly by radiation from the warm walls and floors or by convection as warm air flows into other spaces. There is usually a great expanse of south facing glass in the direct gain house, and two controls are important: one against too much heat gain in the summer and one against too much heat loss at night and on cloudy days (Mazria, 1979). To control or prevent excessive heat gain can be as simple a design as a roof overhang or proper landscaping. The control to prevent excessive heat loss is usually achieved through insulating drapes, sliding panels, or insulating shutters (Sunset,

1979).

A second type of solar home is heated by indirect solar gain. Although materials in the home are the same as those used in the direct gain home, the sun rays do not have to travel through the living space to reach the storage mass (Mazria, 1979). The homeowner will not see or feel the collection of heat, only the storage mass and the distribution of warm air. This system allows the home to collect heat at much higher temperatures than the direct gain method, without possible overheating (Skurka and Naar, 1978). Indirect gain systems have a time-lag feature; solar heat is felt hours after it is collected (Mazria, 1979).

There are three types of indirect-gain passive solar systems: the trombe wall; storage of water in barrels, bottles or bags; and the collection of the sun's rays through the use of water bags, bottles or large water reservoirs set upon or directly under the roof of the home. With the trombe wall, the sun's rays are absorbed directly behind a large south facing glass collection area by a massive wall (often 12 inches thick) which serves as solar storage. This trombe wall is interrupted by windows and by vents at the top and bottom so that hot air between the glass and the trombe wall can flow into the home immediately for distribution by convection. These vents act as a control element, allowing convective heating before the time-lag heat is conducted through the wall mass. The vents are also used in the summer to channel excess heat to the

outside (Hunt, 1982).

In the second type of indirect-gain passive solar system, water is stored in bottles, barrels, or bags behind the south facing glass wall or collector instead of a trombe wall. In this water wall system, solar heat distribution by radiation is faster than in the mass trombe wall home because the hot water makes the inside of the wall immediately warm (Hunt, 1982).

The third indirect-gain passive solar home is more unusual and harder to locate. The collection of solar heat is not through south facing glass walls but on the roof. Distribution, like the radiant ceiling heat in many homes today, is uniform and comfortable. Often called roof pond houses, these homes experience heat loss on a winter night and heat gain on a summer day without adequate protection. For this reason, hinged insulating panels or automatic insulating doors are added so they might be closed to keep the heat within or opened at night to chill the water down (Sunset, 1979).

With the isolated gain system, a sunny space is attached to the main house on the south side to collect and store solar heat. Through the opening of doors, windows and vents, the solar heat can be shared with the main residence. An atrium, a sun-room and a greenhouse can all provide heat by isolated gain. Again, the use of glass with adequate venting systems and heat absorbing masonry walls and

flooring are all that is needed (Hunt, 1982; Mazria, 1979).

Earth Sheltered Dwellings

Building one's home into the earth is a centuries-old concept. Through orientation and design, an earth sheltered home uses the natural insulating properties of the surrounding soil to minimize heat gain and loss and to reduce the effects of airborne noise, high winds and storms (Sterling, 1980).

There are many types of earth sheltered home floor plans. The most typical design will have windows and doors along one side of the structure (preferably facing south) with the roof and remaining walls earth covered. Another is the courtyard or atrium design in which rooms are clustered around a central garden area. Very little physical image is visible with this second design but each room clustered around the courtyard or atrium will have access to natural light. Additional home plans may vary considerably but are modifications of the above designs. Some will have exposed roofs, others will have many openings and exposed walls. The amount of exposure to the elements will determine its energy efficiency (Sterling, 1980; Underground Space Center, 1982).

Earth sheltering can be thought of as a principle rather than a style, for to build homes that use the earth as a natural insulator allows one to save "energy by not requiring it in the first place" (Design Concept Associates,

1980). This aspect is its primary advantage. Those who have built earth sheltered homes agree and speak of the reduced fossil fuel consumption as being more than they had originally expected (Scott, 1980). Other advantages that inhabitants share involve the issues of privacy, a quiet environment and protection from the elements (Scott, 1980; Sterling, 1980; Underground Space Center, 1982).

The recent popularity in returning to earth sheltered dwellings has occurred in the United States as the costs of heating and cooling a home have climbed upward. Prior to the 1970's, only those concerned with preserving existing open space sought this "non-traditional" housing alternative (Labs, 1976). The University of Minnesota Underground Space Center (1979) estimated there to be only 30 to 40 earth sheltered homes in the United States in early 1978; by the end of 1979, that estimate had risen to between 2,000 and 3,000. At the end of 1980, there were an estimated 3,000 to 5,000 earth sheltered homes, according to McGough (1980).

The interest in earth sheltered designs has been adopted for other buildings as well. The Dallas-Fort Worth Airport, San Francisco Civic Center, and the Reston Elementary School in Reston, Virginia are but a few of the earth sheltered or underground structures that are being used today (McGough, 1980; Scott, 1980).

That the growth of earth sheltered dwellings has accelerated in a short period of time is testimony to the

continued development of an alternative building concept that allows one to live in harmony with the environment rather than dominating or possibly destroying it. However, difficulties have been encountered by those wishing to build something that is different or unusual (Sterling, 1980).

A number of articles and books suggest that the institutional barriers are the major obstacles to building this housing alternative (Scott, 1980; Sterling, 1980; Underground Space Center, 1981). The Uniform Building Code and FHA minimum property standards do not address earth sheltered homes per se, but Scott (1980, p. 76) contends that only minor changes are needed to transform the guidelines to apply to earth sheltered dwellings. He indicates a need for "knowledgeable builders, architects, engineers or building officials who have had experience" with these dwellings. Locating a qualified contractor is paramount, for structurally, earth sheltered homes must be built to withstand greater stress loads than their above ground counterparts (Tri-Arch Associates, 1980).

Zoning ordinances are another difficulty, for while adopted to assure community standards for height, setbacks, minimum floor areas and location of dwellings, they are written with conventional housing in mind. Zoning ordinances are also prescriptive, not performance standards, and as such, anything innovative might be prohibited in order to protect the appearance and character of the neighborhood (Underground Space Center, 1979).

Locating financing has been a struggle in far too many instances (Barrett, Epstein and Haar, 1977; Sterling, 1980). Scott (1980, p. 73) agrees, stating the financial institution's "primary concern is the ability to sell a mortgage and to resell a house." With regards to earth sheltered homes, very few have been placed on the market and therefore the resale value has not been adequately determined. Nor has there been any appreciable amount of speculative building by developers (Sterling, 1980).

Difficulties with leaking roofs or walls have been overcome with the development of weatherproofing materials that can withstand the natural pressures from the weight of the earth, ponded water and the movement from expansion and contraction in the walls and roof . . . provided proper attention is given during installation (von Fraunhoffer, 1980). An adequate drainage system built around the perimeter of the home would control water runoff, thus further ensuring a dry and comfortable environment (Tri-Arch Associates, 1980).

Various authors have mentioned another aspect of earth sheltered homes that may prevent the widespread diffusion and adoption of this innovative housing alternative: the consumer's psychological perception of these homes. Those unfamiliar with earth sheltered dwellings fear "claustrophobia, dampness and constant cold" (Tri-Arch Associates, 1980, p. 2). Literature measuring attitudes

toward earth sheltered environments is not lengthy, yet results indicate the adequacy of natural light is a determining factor in the acceptance of this housing alternative (Stewart, McKown and Newman, 1981). Others indicate that well placed skylights, glass wall areas and courtyards that would allow natural light to enter the earth sheltered dwelling without appreciably affecting the insulating properties would help dispell the negative psychological perceptions that consumers now hold (Tri-Arch Associates, 1980).

Diffusion and Adoption of an Innovation

Diffusion is the process by which the acceptance of a specific item, idea or practice is spread by communication means to members of a social system over a period of time (Shiffman and Kanuk, 1978). In more simple terms, it entails the dissemination of an item, idea or practice and culminates in the adoption of that item, idea or practice by individuals or groups. The framework for the study of the acceptance of a new product by consumers is based upon the diffusion and adoption of innovation research first explored by rural sociologists and anthropologists. Today, the study of product acceptance by consumers is more interdisciplinary in nature and also includes the fields of medical sociology, education and marketing, to name just a few.

Of central importance in diffusion studies is the time it takes for consumers to adopt an innovation. Adopters are

defined and classified into categories according to when the innovation was adopted. The success of an innovation is determined by the haste with which the innovation is adopted (Shama, 1982). Rogers (1983) describes a classification scheme that indicates where an individual or group making the decision to adopt an innovation stands in relation to others. These categories take into consideration the background of the consumer, motivational factors and the perceptions the consumer has of the innovation. The first to adopt an innovation are the innovators, followed by the early adopters, early majority, late majority and laggards (Rogers, 1983). "Nonadopters" is an additional category that has often been added by market researchers in order to classify the entire continuum of consumer behaviors (Schiffman and Kanuk, 1978).

Shama (1982, p. 708) uses the following characteristics to describe each of the adoptor categories:

1. Innovators: "young, of high social and economic status, risk takers, cosmopolitan, and prefer impersonal communication sources;"
2. Early Adopters: "these too are young and of high social and economic status, they seek respect, and are extremely capable opinion leaders. Once they adopt an innovation, others are sure to follow;"
3. Early Majority: "are of average social and

economic status and love to show and tell their peers of products they purchase;"

4. Late Majority: "are of below average social and economic status, and they are skeptical about adopting new products. Adoption occurs when the price is low enough and the pressures to adopt are strong; and
5. Laggards: the "last to adopt, these consumers have low social status and income. Their values are very traditional and they are reluctant to purchase and use new products and services."

While differences exist among the disciplines in methodology, analysis and findings, there is a general consensus that the diffusion process evolves into five distinct stages prior to the acceptance of an innovation by a consumer (Rogers, 1983; Schiffman and Kanuk, 1978). The first stage is awareness, during which one learns of the existence of the innovation but has minimal information regarding its attributes or function. During the interest stage, an individual will seek information about the innovation and its functions. The evaluation stage for a consumer is the mental process of determining whether the innovation is the correct choice for a particular situation. The fourth or trial stage is the temporary use of an innovation on a small scale to further determine its advantages/disadvantages. And the fifth stage is the

adoption stage during which the consumer purchases the innovation for continued use based upon the results of the previous trial period (Shama, 1982).

One's perception of the inherent characteristics of an innovation will also determine consumer acceptance (Katz, 1963; Rogers, 1983; Shama, 1982). Shama (1982, p. 706) notes that these factors are "totally in the eye of the beholder" but this will be especially true during the evaluation stage of the adoption process.

Past studies indicate six characteristics will determine consumer acceptance of an innovation:

1. Relative Advantage: Consumers may perceive the advantage of energy efficient housing alternatives as providing low cost space heating and cooling which also reduces their dependence on a fossil fuel supply;
2. Risk: Consumers may perceive a risk in adopting an energy efficient housing alternative if they believe there will be higher construction, financing or maintenance costs involved;
3. Compatability: Consumers may perceive the energy efficient housing alternative as being compatable with their own needs, values and experiences with rising energy costs;
4. Complexity: The perceived complexity of new

energy technologies might deter consumer acceptance of energy efficient housing alternatives;

5. Trialabilty: Common marketing practices often include samples for consumer testing of a product. However, a small scale trial of an energy efficient housing alternative is difficult, if not impossible, to achieve;
6. Communicability: The ease and effectiveness of observing and communicating the benefits of solar and earth sheltered dwellings (i.e., convenience, economy and comfort) could help determine consumer acceptance (McCray and Weber, 1981; Rogers, 1983; Shama, 1983; Sterling, 1980).

The transmission of information about an innovation is through two distinct yet complementary sources of communication (Rogers, 1983). The first channel reaches great numbers of people through impersonal sources such as television, magazines, books and newspapers. The second source is more personal in nature and involves the communication of information to a smaller group through relatives, peers, neighbors and friends.

With each method, an opinion leader can greatly influence the acceptance of new information through: 1. the endorsement of an innovation; 2. a discussion of the innovation's attributes; or 3. providing an

interpretation of the impersonal communication sources during a meeting with an individual or group (Schiffman and Kanuk, 1981). Shama (1982, p. 708) indicates the opinion leader's effectiveness will be a function of an individual's "credibility," "perceived expertise" and "trustworthiness."

Based upon the criteria presented by Rogers (1983) and others, active solar, passive solar and earth sheltered homes are energy efficient housing innovations that are in the early stages of the diffusion life cycle. By measuring the degree of innovativeness of people who have adopted these housing types, it may help to identify a means whereby the diffusion/adoption process can be accelerated.

Conclusion

As indicated in this review of literature, energy efficient housing alternatives, namely active solar, passive solar and earth sheltered homes, have recently been built that will consume from 50 to 90 percent less energy than the dwellings built during the 1950's and 1960's (Miller, 1982). But the adoption rate of these alternative housing types has been minimal when compared to the total housing stock in America. If conservation of our finite supply of energy in its primary forms is to be realized, a study of the degree of innovativeness of people living in these alternative housing types would be useful to housing professionals interested in accelerating the rate of adoption.

CHAPTER III

RESEARCH METHODOLOGY

Data for this study were collected in Oklahoma through a larger research project, S-141, "Housing for Low- and Moderate-Income Families," being conducted by the Southern Regional Housing Technical Committee. The current study is a part of Objective A in the larger study and involves the psychological responses of Oklahoma families to their homes. More specifically, the purpose of this study was to develop an instrument that would measure the degree of innovativeness among Oklahomans living in energy efficient alternative housing, i.e., solar and earth sheltered dwellings. A second group of subjects living in conventional homes in Oklahoma was selected and included for comparative purposes. For this study, the demographic characteristics of the household, communication channels, perception of an energy problem, one's leadership role in the community and the attributes of an innovation previously identified through a review of empirical research were used to determine an individual's degree of innovativeness.

In this chapter, the research methodology and procedures used in preparing and executing this study are described. The population and sample selection methods,

description of the instrument used, method of data collection and subsequent analysis are also presented.

Research Design

The research technique employed in this study was identified by Kerlinger (1973) as survey research. In this type of research, samples chosen from populations are studied to discover the relative incidence, distribution and interrelations of sociological and psychological variables. This study is also exploratory and descriptive in nature in that 1. a better understanding of the inhabitants of solar and earth sheltered dwellings will be obtained, and 2. the instrument developed for this study will be validated prior to being used at a later date by the Southern Regional Housing Technical Committee in future investigations of alternative housing occupants. The description of the study sample will be based upon the demographic characteristics. All data were obtained by means of a structured questionnaire that was mailed to the identified subjects.

Population and Sample Selection

Residents within the state of Oklahoma who were living in solar or earth sheltered dwellings comprised the target population for this study. Since a list of all Oklahoma households living in these dwellings does not exist, an effort was made to identify such homes through a variety of means. A total of 365 alternative dwelling types was

identified. A list of 97 people living in earth sheltered homes was obtained from the Architectural Extension Department at Oklahoma State University. A total of 268 people living in solar homes was acquired through telephone and personal contact with Oklahoma architects, builders, distributors and solar collector manufacturers and installers. Of the 365 alternative dwellings thus identified, 359 were useable and comprised the population for the study. Thus, the inferential population and sample are the same in this study for families living in solar or earth sheltered homes.

The multistage cluster sampling method controlling for the age, value and location of dwellings was employed in the selection of conventional homes used in this study (Babbie, 1983). Based upon the geographic location of responses from alternative home dwellers and using those counties which approximated the state proportion of urban and rural population mix, the following five counties were used to select the sample of conventional homes: Canadian, Cleveland, Grady, Kingfisher and McClain. Thus, instead of selecting Oklahoma County, which had the largest number of responses from alternative home dwellers, the four adjacent counties were used for selecting conventional home subjects.

The conventional home sample size was then established proportional to the total population in each county. A total of 396 subjects was chosen from the county tax rolls

based upon the following criteria: 1. the dwelling was built between 1976 and 1983; and 2. the minimum market value in 1980 was $60,000. If a dwelling had been assessed in any year prior to or after 1980, a figure of $3,000 per year decrease or increase would determine the market value for that year. Table I depicts the counties and number of alternative dwelling responses from each and the sample size and county of origin for the selection of conventional homes.

The names and addresses of each dwelling fitting the sampling criteria were noted until the sample size needed for each county was obtained. It was predetermined that the address of the dwelling would take precedence over the name of the owner if the present occupant was different from that listed on the tax rolls.

Description of Instrument

A four sectioned structered questionnaire was developed to meet Objective A of the Southern Regional Housing Technical Committee Project S-141. Thirty-three statements requiring 50 responses were adapted for this study by the researcher and placed in Section II of the instrument sent to all subjects (see Appendix A). Statements were based upon empirical research cited in the review of literature, instruments used in the investigations of similar topics [i.e., the measurement of social-psychological attitudes (Robinson and Shaver, 1969)], and suggestions made by pilot-

TABLE I

LOCATION OF RESPONSES FROM ALTERNATIVE HOME DWELLERS AND CONVENTIONAL HOME SAMPLE

County	Responses From Alternative Home Dwellers		Conventional Home Sample	
	Number	Percent*	Number	Percent
Beckham	2	1.01		
Blaine	5	2.51		
Caddo	5	2.51		
Canadian (Urban)	21	10.55	87	22.00
Carter	1	0.50		
Cherokee	2	1.01		
Cleveland (Urban)	22	11.06	106	27.00
Comanche	3	1.51		
Craig	1	0.50		
Delaware	1	0.50		
Garfield	1	0.50		
Garvin	2	1.01		
Grady (Rural)	15	7.54	85	22.00
Kay	2	1.01		
Kingfisher (Rural)	7	3.52	53	13.00
Logan	2	1.01		
McClain (Urban/Rural)	10	5.03	65	16.00
McCurtain	2	1.01		
Mayes	2	1.01		
Murray	2	1.01		
Muskogee	4	2.01		
Oklahoma	59	29.65		
Osage	1	0.50		
Pawnee	1	0.50		
Payne	4	2.01		
Pottawatomie	3	1.51		
Seminole	1	0.50		
Stephens	3	1.51		
Tulsa	4	2.01		
Washita	1	0.50		
Woodward	1	0.50		
Other**	9	4.52		
TOTAL	199	100.00	396	100.00

*Percentage based upon total number of alternative home responses (n=199).

**Number of respondents unable to be categorized according to county of origin.

test subjects. All statements in the questionnaire were based on the diffusion research paradigm identified by Rogers (1983).

Using the model shown in Figure 1 (see Chapter 1, page 6), 32 one sentence statements were formulated for the following categories:

Category	Statement Number
Relative Advantage	1, 2, 3, 4
Risk	5, 6, 7
Complexity	8, 9, 10
Compatability	11, 12, 13
Trialability	14, 15, 16
Leadership role in Community	17, 18, 19, 20, 21
Perception of an Energy Problem	22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32.

The above statements were followed by 18 sources of information one might seek when making a major purchase. Fifteen of these sources were of an impersonal nature while friends, neighbors and relatives were more personal. All information sources are listed under statement number 33 in Section II of the questionnaire and correspond to the category "Communication Channels" in Figure 1. Thus, factors that might affect the adoption of an innovation represented:

1. communication channels of a personal and impersonal nature,
2. one's leadership role in the community,

3. a perception of a problem (which for this study was the perception of an energy problem), and
4. the attributes of an innovation (i.e., its relative advantage, risk, complexity, compatability and trialability).

A five-point Likert scale with a range from "strongly agree" (scored as 5) to "strongly disagree" (scored as 1) was selected for subjects to record their reactions of agreement or disagreement with each of the statements. Likewise, a five-point Likert scale with "definitely helpful" (scored as 5) to "definitely not helpful" (scored as 1) was provided for responses to information sources listed.

The selected statements were pilot-tested (Appendix B) among five conventional home dwellers chosen at random in Stillwater, Oklahoma to determine the clarity of each. Suggestions made by pilot-test subjects concerned only the inclusion of additional information sources they found helpful when deciding to make a major purchase. These sources were included in the instrument sent to the subjects of this study (see Appendix A).

In addition to the aforementioned statements, various demographic data were also collected, including sex, age, race, marital status, education and income levels and occupational status. Requests for this information were

located in Section IV of the questionnaire. To differentiate dwelling types and further describe the homes of respondents, selected data were analyzed from Section I.

Collection of Data

Data for this study were collected from residents living in solar, earth sheltered and conventional dwellings between March and May, 1983. The questionnaire, a pre-addressed stamped envelope and a cover letter stating the purpose and importance of the study were mailed to all subjects. Each questionnaire was coded for identification purposes only and names were not requested to assure anonymity. Those not responding within the stated time limit were mailed a second letter requesting their cooperation in completing and returning the instrument. Letters mailed to subjects can be found in Appendix C.

Analysis of Data

Data obtained were coded and recorded on cards for electronic computation. Data were then statistically analyzed using the Statistical Analysis System (SAS) provided by the University Computer Center, Oklahoma State University, Stillwater, Oklahoma.

Frequency analysis and percentage distributions were used on all variables under consideration in this study. In addition, overall mean and standard deviation scores for each variable were calculated. Factor analysis principal

method with varimax rotation was used in the attempt to find common variances among the tested items and to test the conceptual framework on which this study was based (Figure 1). The predominant clusters or dimensions that ensued would lend construct validity to the instrument and identify factor dimensions. Items with factor loadings less than 0.40 were then deleted from further analysis.

F and t-test statistics were used to test for significant differences between mean scores among major and subfactor dimensions. To further explain variation found among conventional, solar and earth sheltered subjects, 1. analysis of variance (ANOVA) was used to determine significant mean differences, 2. Duncan's Multiple Range Test was applied to the data to identify which differences between mean scores were significant, 3. Product moment correlation analysis was used to determine the degree of relationship between innovative attitude dimensions and demographic characteristics, and 4. the Chi-square test of significance was employed to define the causal relationships between major and subfactor dimensions. The 0.05 level was chosen as the minimum level at which the results would be considered significant.

Results

Factor Analysis of Instrument Variables

Based on the review of literature, 50 items were

selected to represent the major and sub categories hypothesized to measure an innovative attitude (Figure 1). Factor analysis prinicipal method with varimax rotation was used:

1. To test the conceptual framework on which this study was based,
2. To provide construct validity for the instrument, and
3. To select representative descriptors for the predominant clusters identified.

Using the framework outlined in Figure 1, nine factors were expected. These were: Personal Sources; Impersonal Sources; Perception of an Energy Problem; Leadership in Community; Relative Advantage; Complexity; Trialability; Compatability; and Observability. The initial factor analysis of data yielded 16 factors instead of the expected nine. Retained for further analysis were the first eight factors representing 50 percent or more common variance. Included in the eight factors retained were 30 of the initial 50 items. Table II lists each factor dimension, descriptors within each dimension and the factor loadings for each descriptor found with this initial procedure.

The 30 items were again submitted to factor analysis to obtain a clear factor structure. The major clusters with similar loadings reappeared. These 30 descriptors and the major factor dimensions were then compared with those in the

TABLE II

EIGHT FACTOR DIMENSIONS RETAINED AFTER INITIAL FACTOR ROTATION OF ALL VARIABLES

Factor Dimension	Major Dimensions and Descriptors	Initial Factor Loading
Factor 1:	Reference Sources	
	Books	.72
	Research Journal Articles	.75
	"How-to-do-it" Articles	.70
	Educational Specialists	.70
	Consumer Groups	.54
	Governmental Agencies	.57
	Library	.74
	Trade or Professional Organizations	.55
	Manufacturer's Representatives	.41
Factor 2:	Media Advertising	
	Newspaper Advertising	.76
	Magazine Advertising	.70
	Radio Advertising	.83
	Television Advertising	.80
Factor 3:	Personal Sources of Information	
	Friends	.82
	Neighbors	.84
	Relatives	.79
Factor 4:	Leadership Role/Community Involvement	
	Among my friends or neighbors, I am considered a good source of advice about political issues.	.72
	I am highly involved in civic and political issues.	.87
	I often attend meetings where economic issues are discussed.	.82
Factor 5:	Compatability with Beliefs/Values	
	I believe I can contribute to the energy conservation movement.	.75
	Based on the experiences I have had while living in my home, I would recommend it to others.	.66
	The average citizen influences the total amount of energy consumed in the United States each year.	.51
	I believe solar and earth sheltered homes are too complicated for most Americans.	.48
Factor 6:	Source of Energy Problem	
	The oil companies in the United States are trying to make large profits.	.90
	The utility companies in the United States are trying to make large profits.	.86
	The energy shortage is part of a political scheme.	.59
Factor 7:	Risk Taker	
	I would be willing to try a new product if it would save me money each month on utility bills.	.65
	I like to be one of the first to try new products.	.73
	I find difficult situations a challenge.	.62
Factor 8:	Periodic Literature	
	Newspaper Articles	.74
	Magazine Articles	.74

hypothesized model (Figure 1). Because of the inherent characteristics of the descriptor variables selected through factor analysis, factor dimensions were renamed when appropriate and classified reflecting the hypothesized model categories. Using the adjusted factor structure the hypothesized model was changed to reflect the results of factor analysis. Results of this procedure are reported in Figure 2. The adjusted model shown in Figure 3 became the basis of hypothesis formation and subsequent analysis of the data to measure the innovative attitude of respondents.

To determine whether or not the factor structure for the total sample would be representative of the various dwelling types under consideration in this study, factor analysis was completed for conventional, solar and earth sheltered dwellers separately. While variations did occur in factor dimensions and descriptors within each dimension, the initial factor structure remained fairly consistent across all dwelling categories. Using the factor dimension framework found for the total sample, the factor loadings for conventional, solar, and earth sheltered respondents are displayed in Table III. The rotated factor pattern, factor dimensions, and descriptors for each dimension as they actually appeared can be found in Table XV, Appendix D.

Explanation of Figure 2

Of the original 18 information sources found in the questionnaire to represent communication channels, all but

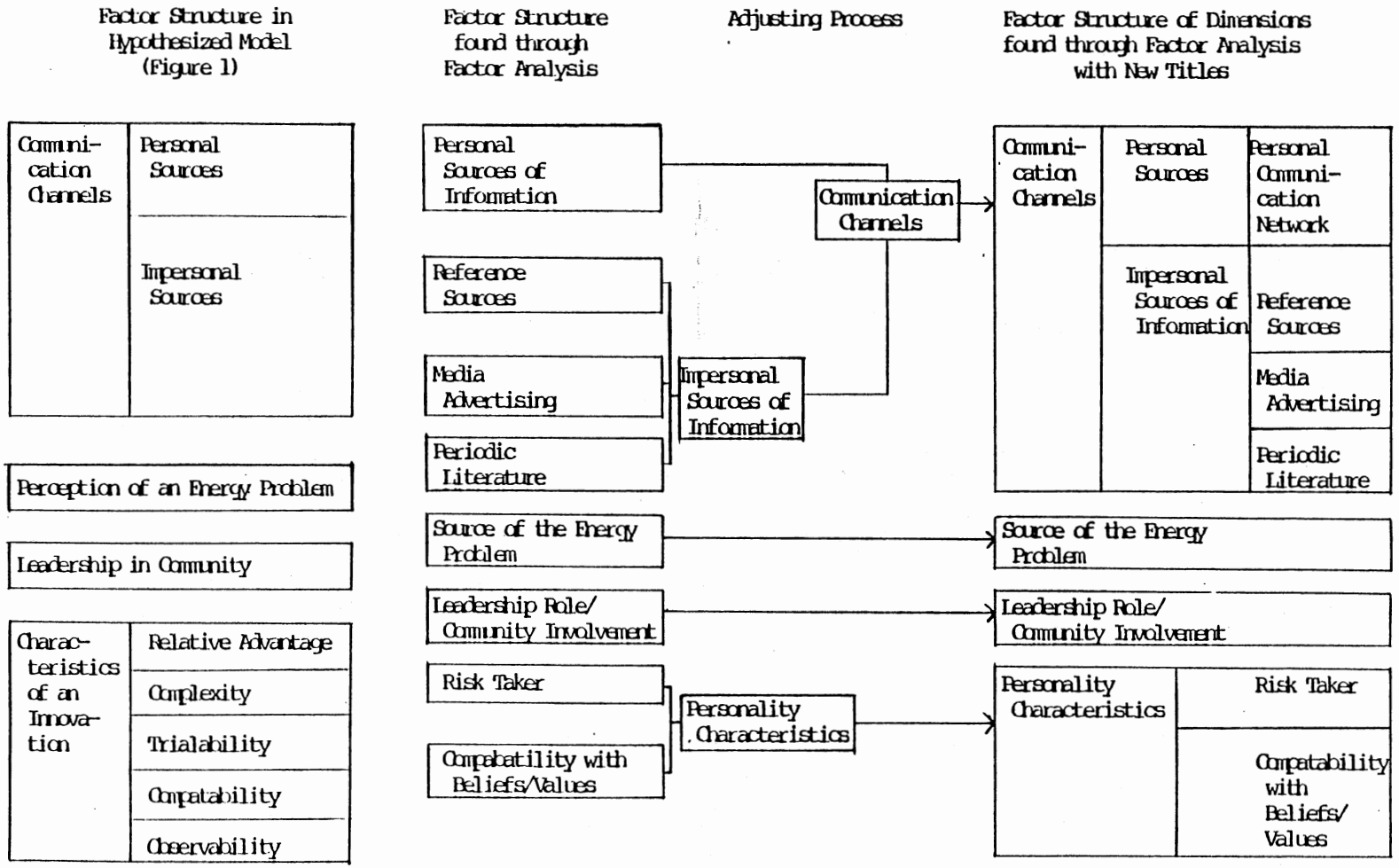


Figure 2. Model of Adjusted Factor Structure Based Upon Factor Dimensions Found Through Factor Analysis

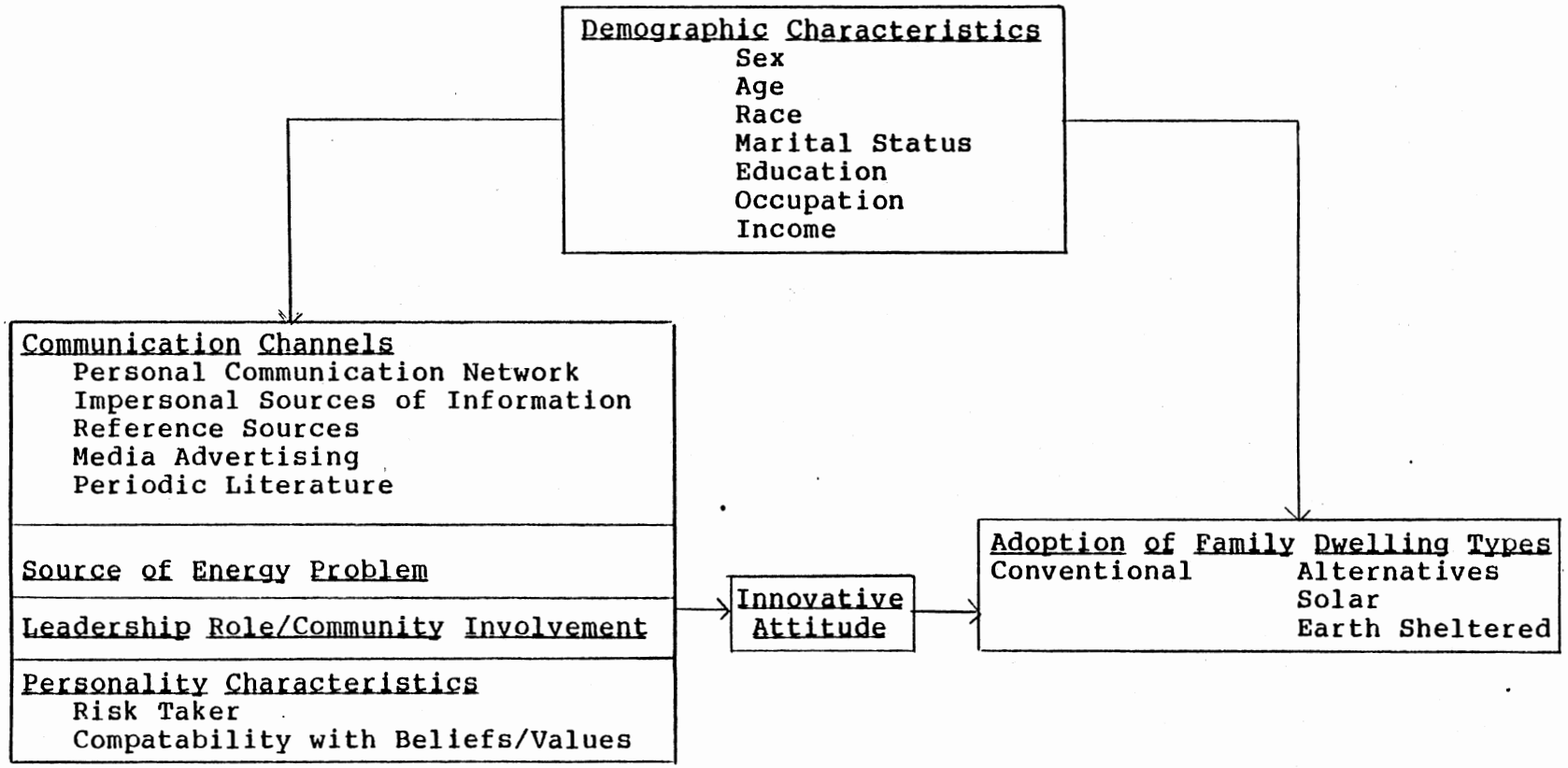


Figure 3. A Model of Dimensions used in the Measurement of an Innovative Attitude

TABLE III

FACTOR LOADING FOR CONVENTIONAL, SOLAR AND EARTH SHELTER RESPONDENTS BASED UPON FACTOR DIMENSIONS FOUND FOR TOTAL SAMPLE

Factor	Dimensions/ Descriptors	Total Sample Factor Loading	Conventional Factor Loading	Solar F/L	Earth F/L
1	REFERENCE SOURCES				
	Books	.66	.75	.77	.70
	Research Journal Articles	.73	.65	.74	.77
	"How-to-do-it" Articles	.64	.52	.62	.67
	Educational Specialists	.67	.66	.69	.77
	Manufacturer's Representatives	.49	.54	.46	.77
	Consumer Groups	.60	.74	.54	.57
	Governmental Agencies	.63	.74	.64	.63
	Library	.77	.69	.81	.88
	Trade or Professional Organizations	.66	.45	.51	.51
2	PERSONAL COMMUNICATION NETWORK				
	Friends	.85	.89	.80	.85
	Neighbors	.86	.87	.84	.90
	Relatives	.80	.67	.82	.79
3	MEDIA ADVERTISING				
	Newspaper Advertising	.74	.74	.57	.62
	Radio Advertising	.84	.79	.86	.72
	Television Advertising	.85	.82	.87	.88
4	COMPATABILITY WITH BELIEFS/VALUES				
	I believe I can contribute to the energy conservation movement.	.82	.82	.75	.61
	Based on the experience I have had while living in my home, I would recommend it to others.	.63	.67	.80	.83
	The average citizen influences the total amount of energy consumed in the United States each year.	.62	.66	.79	.44
5	LEADERSHIP ROLE/COMMUNITY INVOLVEMENT				
	Among my friends or neighbors, I am considered a good source of advice about political issues.	.78	.77	.79	.48
	I am highly involved in civic and political issues.	.89	.90	.89	.60
	I often attend meetings where economic issues are discussed.	.80	.89	.79	.83
6	SOURCE OF ENERGY PROBLEM				
	The oil companies in the U.S. are trying to make large profits.	.90	.91	.87	.77
	The utility companies in the U.S. are trying to make large profits.	.88	.89	.86	.73
	The energy shortage is part of a political scheme.	.65	.50	.64	.59
7	PERIODIC LITERATURE				
	Newspaper Articles	.80	.79	.86	.81
	Magazine Articles	.77	.55	.75	.75
8	RISK TAKER				
	I would be willing to try a new product if it would save me money each month on utility bills.	.64	.75	.70	.75
	I like to be one of the first to try new products.	.73	.80	.62	.50
	I find difficult situations a challenge.	.65	.36	.73	.86

"magazine advertising" were retained after factor analysis. The remaining sources were expected to cluster into personal sources, and the impersonal sources, mass media and contact with experts. The descriptors for personal sources of information remained the same after factor analysis. However, the descriptors measuring impersonal sources of information factored into three distinct dimensions instead of the two expected. These three factor dimensions were renamed references sources, media advertising, and periodic literature. The factor dimensions and descriptors that clustered on the first factor rotation remained fairly consistent for all housing types (Table XV, Appendix D).

Eleven statements were included in the questionnaire that addressed different aspects of the energy problem. Of the 11, only three correlated highly together after factor analysis. Rather than describing a perception of an energy problem, the descriptors indicated the source of the energy problem. The name of the major factor dimension was changed accordingly. These three descriptors were consistently clustered together for all housing types.

The three statements in the questionnaire selected to measure one's leadership in the community were retained after factor analysis. Yet, when each housing type was analyzed separately, other descriptors were sometimes included in the cluster which indicated both a leadership role and involvement in the community. Thus, the major dimension title was changed to leadership role/community

involvement.

Eighteen statements representing five categories (relative advantage, complexity, trialability, compatability, and observability) were included in the questionnaire to measure one's perception of the inherent characteristics of an innovation. All but seven of the statements were eliminated after factor analysis. The remaining seven more accurately described personality traits of respondents and as such, the major dimension title was changed to personality characteristicss. Risk taker and compatability with beliefs/values were chosen as titles to reflect the descriptors found within the factor clusters. The two factor clusters and their descriptors were generally consistent across all housing types.

Hypothesis Formation

As previously stated, the purpose of this study was to develop an instrument to examine the attitudes held by two groups of households (people living in conventional versus alternative housing types) in order to determine if there was a relationship between the type of dwelling chosen and the attribute innovativeness previously identified by Rogers (1983). Research questions were formulated and presented in Chapter I. These questions guided this study and now form the basis of the following hypotheses:

1. Hypothesis corresponding to research question 1:

Ho_1: There are no significant differences between respondents living in solar, earth sheltered or conventional dwellings in terms of their innovative attitude or related subfactor dimensions.

2. Hypothesis corresponding to research question 2:

Ho_2: There are no significant differences between the demographic variables sex, age, race, marital status, educational and income levels and occupational status and an innovative attitude among all respondents regardless of housing type.

Summary

This chapter has considered the design and methodology used in the completion of this research study. Mention was made of the population, sample, instrumentation and statistical treatment of the data.

Chapter IV will present, analyze and discuss the results of the analysis of the data obtained in this study in relationship to the research questions discussed in Chapter I and the hypotheses stated in this chapter.

CHAPTER IV

FINDINGS

The major purpose of this study was to develop an instrument that would measure an innovative attitude among people living in solar and earth sheltered dwellings. The adopters of these energy efficient alternative types of housing became the sample group for this study. A second group comprised of people living in conventional homes was used for comparison purposes.

Findings in this study are based upon the self-reported responses contained in a total of 297 returned questionnaires of the 754 that were mailed to all subjects. This total represents an overall return rate of 39.39 percent. It must be noted however, that 199 out of 359 questionnaires were returned from respondents living in alternative homes which represents a 55 percent return rate from this group. The total number of questionnaires returned by respondents living in conventional homes was 98 out of the 396 mailed representing a 25 percent return rate. As previously stated, in an effort to increase the rate of return a pre-addressed, stamped envelope was enclosed with the mailing of the questionnaires. In addition, efforts were made to contact subjects who had not responded within a

specified time period via a follow-up letter (Appendix C).

The results of the present research will be reported by the following methods: 1. the total number of respondents (n=297 or 100%); 2. by respondents from alternative homes (n=199 or 67.00% of respondent total) and conventional homes (n=98 or 33.00% of respondent total); and 3. by dwelling categories, i.e., solar homes (n=146 or 49.16% of respondent total), earth sheltered homes (n=53 or 17.85% of respondent total) and conventional homes (n=98 or 33.00% of respondent total). While the total number of useable questionnaires returned was 297, the total number of responses reported for each variable may differ due to missing data. The results of data analysis are presented in the following order: sample characteristics, dwelling characteristics, testing of hypotheses, and other findings.

Sample Characteristics

Table IV presents sample characteristics by demographic and housing type variables. Ages ranged from 26 to 85 years of age. When respondents' ages were grouped into three categories for analysis purposes, 47 percent of the total sample were in the 36 to 55 year range. The mean age of respondents was 44 years old. Ninety-three percent of the total sample were white and over 89 percent of the respondents were married. Seventy percent of the respondents living in conventional homes and 79 percent of the respondents living in alternative dwelling types were

TABLE IV

DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

Demographic Characteristics	Category	Total		Conventional Homes		Alternative Homes		Solar Homes		E/S Homes	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Sex	Male	217	76.14	65	70.00	152	79.17	113	79.58	39	78.00
N=285	Female	68	23.86	28	30.00	40	20.83	29	20.42	11	22.00
Age	26-35 years	72	26.67	26	29.21	46	25.41	35	25.55	11	25.00
N=270	36-55 years	127	47.04	39	43.82	88	48.62	66	48.18	22	50.00
	55+ years	71	26.30	24	26.97	47	25.97	36	26.28	11	25.00
Race	White	267	93.36	88	93.12	179	93.23	133	93.66	46	92.00
N=286	Non-white	19	6.64	6	6.38	13	6.77	9	6.34	4	8.00
Marital Status	Married	265	92.33	84	89.36	265	92.33	136	95.10	45	90.00
N=287	Not Married	22	7.67	10	10.64	22	7.67	7	4.90	5	10.00
Education	0-12 years	85	29.62	29	30.85	56	29.02	39	27.27	17	34.00
	13-17 years	135	47.04	42	44.68	93	48.19	71	49.65	22	44.00
N=287	17+ years	67	23.34	23	24.47	44	22.80	33	23.08	11	22.00
Occupation	Prof/Tech	161	56.49	56	60.22	105	54.69	75	52.82	30	60.00
	Non-prof/Service	66	23.16	19	20.43	47	24.48	35	24.65	12	24.00
N=285	Farm/Farm Manager	7	2.46	2	2.15	5	2.60	5	3.52		0.00
	Housewife	28	9.82	9	9.68	19	9.90	14	9.86	5	10.00
	Retired	23	8.07	7	7.53	16	8.33	13	9.15	3	6.00
Income	To $19,999	12	4.33	2	2.17	10	5.41	1	0.73	9	19.15
N=277	$20,000-$34,999	64	23.10	14	15.22	50	27.03	37	26.81	13	27.66
	$35,000+	201	72.57	76	82.61	125	67.57	100	72.46	25	53.19

Note: Only responses of respondents were recorded for analyzing purposes. Totals may differ due to missing data.

male.

The educational level of respondents in this study were quite similar for conventional and alternative home dwellers. Thirty percent of conventional and 29 percent of the alternative home respondents had a high school education or less. Forty-four percent of conventional and 48 percent of the alternative home respondents had one to four years of college, technical school training or were college graduates. Twenty-four percent of conventional and 22 percent of the alternative home respondents had attended graduate school or obtained a graduate degree.

Sixty percent of conventional and 55 percent of alternative home respondents listed occupations of a professional or technical nature. Twenty percent of the conventional and 24 percent of the alternative home dwellers had non-professional or service occupations. Two percent of each dwelling category were farmers or farm managers and 9 percent of each were housewives. Seven percent of conventional and 8 percent of alternative home respondents were retired. Again, the findings for the occupations of respondents living in conventional and earth sheltered dwellings were very similar across all categories. More than 50% of the respondents across all categories had a minimum yearly income of $35,000.

Dwelling Characteristics

In order to make an adequate test of the research

objectives, a concerted effort was made to obtain a large sample of responses from people living in alternative and conventional homes. Table V lists the sample size of respondents and county location of these homes.

Table VI depicts the dwelling characteristics of the total sample in this study. Of the 295 sample dwellings, 197 or 66 percent were seven years old or less, 16 percent were between 8 and 14 years old and the remaining 16 percent of the sample were 15 years old or older. The majority of respondents (76 percent) had lived in their homes for a period of seven years or less, 13 percent lived between 8 and 14 years in their homes, and the remaining 11 percent 15 years or longer.

Thirty-seven percent of the respondents were living in a home that was between 1,501 and 2,000 square feet in size. Twenty-six percent of the homes were reported to be between 2,001 and 2,500 square feet, 14 percent between 2,501 and 3,000 square feet and 15 percent were more than 3,001 square feet in size. Only eight percent of the respondents were living in a dwelling that was 1,500 square feet or less in size.

Testing of Hypothesis One

The analyses of data were organized under the hypothesis developed to answer each of the research questions listed in Chapter I. The null hypothesis

TABLE V

RESPONDENTS' DWELLING LOCATION BY COUNTY

County	Total Sample n=297 %=100.00		Alternative Homes n=199 %=67.00		Conventional Homes n=98 %=33.00	
	Number	Percent	Number	Percent	Number	Percent
Beckham	2	0.67	2	0.67		
Blaine	5	1.68	5	1.68		
Caddo	6	2.02	5	1.68		
Canadian	41	13.81	21	7.07	20	6.73
Carter	1	0.34	1	0.34		
Cherokee	2	0.67	2	0.67		
Cleveland	35	11.79	22	7.41	13	4.38
Comanche	3	1.01	3	1.01		
Craig	1	0.34	1	0.34		
Delaware	1	0.34	1	0.34		
Garfield	1	0.34	1	0.34		
Garvin	2	0.67	2	0.67		
Grady	39	13.13	15	5.05	24	8.08
Kay	2	0.67	2	0.67		
Kingfisher	26	8.75	7	2.36	19	6.40
Logan	2	0.67	2	0.67		
McClain	28	9.43	10	3.37	18	6.06
McCurtain	2	0.67	2	0.67		
Mayes	2	0.67	2	0.67		
Murray	2	0.67	2	0.67		
Muskogee	4	1.35	4	1.35		
Oklahoma	60	20.20	59	19.87		
Osage	2	0.67	1	0.34		
Pawnee	1	0.34	1	0.34		
Payne	4	1.35	4	1.35		
Pottawatomie	4	1.35	3	1.01		
Seminole	1	0.34	1	0.34		
Stephens	4	1.35	3	1.01		
Tulsa	4	1.35	4	1.35		
Washita	1	0.34	1	0.34		
Woodward	1	0.34	1	0.34		
Other	8	2.69	9	3.03	4	1.35
TOTAL	297	100.01	199	67.01	98	33.00

Note: Only the responses of respondents were recorded for analyzing purposes. Therefore, totals may differ due to missing data.

TABLE VI

DWELLING CHARACTERISTICS OF SAMPLE

Dwelling Characteristics	Category	Frequency	Percent
Age of dwelling	0-7	197	66.78
	8-14	49	16.61
	15-21	20	6.78
	22-28	15	5.09
	28+	14	4.75
Years of residence	0-7	224	76.45
	8-14	38	12.97
	15-21	20	6.83
	22-28	8	2.73
	28+	3	1.02
Square footage of dwelling	500-1,000	2	0.68
	1,001-1,500	23	7.85
	1,501-2,000	107	36.52
	2,001-2,500	76	25.94
	2,501-3,000	42	14.33
	3,001-3,500	18	6.14
	3,501-4,000	12	4.10
	4,001+	13	4.44

developed in relation to the first research question was:

Ho_1: There are no significant differences between respondents living in conventional, solar, or earth sheltered dwellings in terms of their innovative attitude or related factor dimensions.

This hypothesis was first tested by the t-test method, with respondents categorized into two groups: conventional versus alternative home dwellers (Table VII). Those factor dimensions found significant were further analyzed via the F test and Duncan's Multiple Range method.

No significant differences between conventional and alternative home dwellers were found for the following variables: 1. innovative attitude; 2. communication channels; 3. impersonal sources of information, including reference sources, media advertising and periodic literature; 4. source of the energy problem; and 5. leadership role/community involvement. Therefore, the first null hypothesis was not rejected for these variables.

There were significant differences found among conventional and alternative home dwellers for the following variables: personal sources of information and personality characteristics including risk taker and compatability with beliefs/values. The first null hypothesis was rejected for these four variables. To assess where those differences were, the F test and Duncan's Multiple Range Test were employed (Table VIII).

TABLE VII

T-TEST OF INNOVATIVE ATTITUDE FACTOR DIMENSIONS BY CONVENTIONAL AND ALTERNATIVE DWELLING TYPES

Dependent Variable	Independent Variable	N	Mean	S.D.	T
Innovative Attitude	Conv.	86	106.86	11.41	-1.67
	Alt.	172	109.31	10.94	
Communication Channels	Conv.	87	61.98	7.72	0.33
	Alt.	184	61.63	8.29	
Personal Sources of Information	Conv.	95	11.67	1.92	2.17*
	Alt.	192	11.11	2.14	
Impersonal Sources of Information	Conv.	92	34.14	4.92	0.29
	Alt.	189	33.96	4.68	
Reference Sources	Conv.	88	31.53	5.81	-1.42
	Alt.	187	32.62	6.09	
Media Advertising	Conv.	93	10.62	2.54	1.60
	Alt.	193	10.11	2.56	
Periodic Literature	Conv.	96	7.89	1.30	0.57
	Alt.	193	7.79	1.33	
Source of Energy Problem	Conv.	96	10.19	2.99	-0.87
	Alt.	193	10.49	2.69	
Leadership Role/Community Involvement	Conv.	95	7.59	2.93	-0.90
	Alt.	192	7.90	2.58	
Personality Characteristics	Conv.	92	26.96	3.34	-4.87**
	Alt.	186	29.09	3.53	
Risk Taker	Conv.	94	10.95	1.96	-2.63*
	Alt.	190	11.63	2.11	
Compatability with Beliefs/Values	Conv.	93	15.96	2.09	-5.49**
	Alt.	189	17.40	2.06	

*Significant at = 0.05 level

**Significant at = 0.01 level

TABLE VIII

F-TEST AND DUNCAN'S MULTIPLE RANGE COMPARISON TEST FOR SELECTED VARIABLES BY CONVENTIONAL, SOLAR AND EARTH SHELTERED DWELLING TYPES

Variable/Descriptors	N	Mean	F	Duncan's[a]
Personal Sources of Information				
Conventional	95	11.67	3.03*	A
Solar	142	11.21		AB
Earth Sheltered	50	10.82		B
Personality Characteristics				
Earth Sheltered	48	29.31	11.73**	A
Solar	138	29.01		A
Conventional	92	26. 96		B
Risk Taker				
Solar	142	11.63	3.45*	A
Earth Sheltered	48	11.63		A
Conventional	94	10.95		B
Compatability with Beliefs/Values				
Earth Sheltered	49	17.71	15.98**	A
Solar	140	17.29		A
Conventional	93	15.96		B

[a]Means with the same letter are not significantly different.

*Significant at the 0.05 level.

**Significant at the 0.0001 level.

With regard to the use of personal sources of information, a significant difference ($p<0.05$) was found between conventional and earth sheltered home dwellers. However, the results for solar home dwellers were not clear with this variable. In the present study, conventional home dwellers were more likely to use personal sources of information than earth sheltered dwellers.

For the major factor dimension personality characteristics, earth shelter and solar respondents are significantly different from conventional respondents for this variable. Further testing of the subfactor dimensions, risk taker and compatability with beliefs/values, was necessary to determine where those differences might be within the major factor dimension personality characteristics. Results indicate solar and earth shelter dwellers were more willing to take risks than the conventional home respondents in this study. A significant difference ($p<0.01$) was found between earth shelter and solar home respondents versus conventional dwellers with the factor dimension compatability with beliefs/values. This finding may give a greater insight into the ideas shared by earth sheltered and solar home dwellers towards their home and the contribution they make to the energy conservation movement as being more compatable with their beliefs and values.

The null hypothesis developed in relation to the second research question was:

Ho_2: There are no significant differences between the demographic variables sex, age, race, marital status, educational and income levels and occupational status and an innovative attitude among all respondents regardless of housing type.

As with the first hypothesis, the second null hypothesis was tested by the t-test method to determine significant differences among demographic variables having only two categories of descriptors. The F test and Duncan's Multiple Range Test were used to determine significant differences among demographic variables having more than two categories of descriptors.

No significant differences ($p>0.05$) were found among conventional, solar and earth sheltered home dwellers in all factor dimensions of an innovative attitude analyzed for the following demographic variables: sex, age, marital status and occupation (see Tables XVI, XVII, XVIII and XIX, Appendix D). Therefore, the second null hypothesis was not rejected for these variables. There were significant differences found among some innovative attitude factor dimensions for the following demographic variables of respondents: race, educational level and income.

No significant differences were found between white and non-white respondents for the following factor dimensions: 1. innovative attitude; 2. communication channels, including the personal and impersonal sources of

information; 3. leadership role/community involvement; and 4. compatability with beliefs/values. Thus, for the demographic variable race, the second null hypothesis was not rejected for the above dimensions (Table IX).

A significant difference was found between white and non-white respondents among the following dimensions: 1. source of the energy problem; 2. personality characteristics; and 3. risk takers. Therefore, the second null hypothesis was rejected for these dimensions (Table IX).

Findings signify ($p<0.05$) non-white respondents perceive the source of the energy problem as having a significantly greater influence than white respondents. Likewise, for the composite dimension Personality Characteristics, non-white respondents were found to be significantly different ($p<0.01$) from white respondents. White respondents were also found to be significantly different ($p<0.05$) than non-white respondents for the variable risk taker.

No significant differences were found among the educational levels of respondents and the communication channels they use. Therefore, the second null hypothesis was not rejected for this factor dimension (Table X).

Significant differences ($p<0.05$) were found among the educational levels of respondents with regards to their 1. perception of the source of the energy problem; 2. leadership role/community involvement; and

TABLE IX

T-TEST OF INNOVATIVE ATTITUDE FACTOR DIMENSIONS BY RACE

Factor Dimension	Descriptor	N	Mean	S.D.	T
Innovative Attitude	White	239	108.77	10.90	1.51
	Nonwhite	18	104.72	12.13	
Communication Channels	White	251	61.86	8.10	1.22
	Nonwhite	18	59.44	8.95	
Personal Sources of Information	White	265	11.29	2.08	0.59
	Nonwhite	19	11.00	2.16	
Impersonal Sources of Information	White	261	34.10	4.68	1.04
	Nonwhite	18	32.89	5.81	
Reference Sources	White	254	32.44	5.92	1.36
	Nonwhite	18	30.44	7.05	
Media Advertising	White	265	10.21	2.60	-0.63
	Nonwhite	18	10.61	2.33	
Periodic Literature	White	268	7.82	1.27	0.62
	Nonwhite	19	7.63	1.83	
Source of Energy Problem	White	267	10.31	2.76	-2.09*
	Nonwhite	19	11.68	2.89	
Leadership Role/Community Involvement	White	264	7.91	2.77	0.51
	Nonwhite	19	7.58	2.52	
Personality Characteristics	White	254	28.50	3.51	2.70**
	Nonwhite	19	26.21	4.33	
Risk Taker	White	261	11.48	2.01	2.17*
	Nonwhite	19	10.42	2.76	
Compatability with Beliefs/Values	White	258	16.97	2.18	2.27
	Nonwhite	19	15.79	2.20	

*Significant at = 0.05

**Significant at = 0.01

TABLE X

F TEST AND DUNCAN'S MULTIPLE COMPARISON TEST FOR INNOVATIVE ATTITUDE RELATED FACTOR DIMENSIONS BY EDUCATIONAL LEVEL

Dimensions/Descriptors	N	Mean	F	Duncan's[a]
Communication Channels				
17+ years	65	62.51	1.29	A
13-16 years		62.07		A
0-12 years		60.48		A
Source of Energy Problem				
0-12 years	84	11.30	9.95***	A
13-16 years	137	10.40		B
17+ years	66	9.32		C
Leadership Role/ Community Involvement				
17+ years	66	8.30	4.12*	A
13-16 years		8.12		A
0-12 years		7.17		B
Personality Characteristics				
13-16 years	135	28.82	5.14**	A
17+ years	64	28.72		A
0-12 years	75	27.24		B

[a]Means with the same letter are not significantly different.

*Significant at = 0.05

**Significant at = 0.01

***Significant at = 0.0001

3. personality characteristics. The second null hypothesis was rejected for these dimensions (Table X).

There was a significant difference ($p<0.001$) found among each of the three levels of education analyzed for the variable source of the energy problem. These differences suggest respondents having 12 years of education or less perceive the source of the energy problem as having a significantly greater influence than respondents with one to four years of college or technical school training, or those having graduated from college. Likewise, those respondents who have attended graduate school or obtained a graduate degree, perceive the source of the energy problem as being less significant than those with less educational attainment.

Findings indicate respondents who have attended college, graduated, entered graduate school or obtained a graduate degree are significantly different ($p<0.05$) from respondents having 12 years of education or less with regards to the variable leadership role and community involvement. Results suggest respondents who have attended at least some college are more involved in their community and assume a leadership role more frequently than those respondents who have not attended college. Results of analysis indicate for the variable Personality Characteristics, respondents who have attended college, graduated, entered graduate school or obtained a graduate degree are significantly different ($p<0.01$) from those

respondents with 12 or less years of education.

No significant differences were found among the income levels of respondents with regards to 1. the communication channels used; 2. one's leadership role/community involvement; and 3. the personality characteristics of respondents. It should be noted, however, that the Duncan's Multiple Range Test indicates a difference in those earning $35,000 or more from those earning $19,999 or less, but the level of confidence is below that deemed significant for this study ($p<0.05$). Therefore, the second null hypothesis was not rejected for these factor dimensions (Table XI).

A significant difference ($p<0.01$) was obtained among the income levels of respondents with regards to their perception of the source of the energy problem. Respondents earning $34,999 per year or less perceive the source of the energy problem as having a significantly greater influence than respondents earning $35,000 or more yearly. Thus, the second null hypothesis was rejected for this factor dimension (Table XI).

Other Findings

Person's product moment correlation coefficients were used to determine whether, and to what degree, relationships existed among the variables related to an innovative attitude and demographic characteristics of respondents in this study. The major and subfactor dimensions of an

TABLE XI

F TEST AND DUNCAN'S MULTIPLE COMPARISON TEST FOR INNOVATIVE ATTITUDE RELATED FACTOR DIMENSIONS BY INCOME

Dimensions/Descriptors	N	Mean	F	Duncan's[a]
Communication Channels				
$35,000+	187	62.09	0.69	A
to $19,999	12	61.42		A
$20,000 - $34,999	62	60.69		A
Source of Energy Problem				
$20,000 - $34,999	65	11.65	11.12*	A
to $19,999	12	11.58		A
$35,000+	200	9.92		B
Leadership Role/ Community Involvement				
$35,000+	200	8.07	1.14	A
to $19,999	11	7.18		A
$20,000 - $34,999	65	7.06		A
Personality Characteristics				
$35,000+	193	28.58	2.25	A
$20,000 - $34,999	61	28.21		AB
to $19,999	12	26.42		B

[a]Means with the same letter are not significantly different.

*Significant at = 0.0001

innovative attitude included: communication channels; personal sources of information; impersonal sources of information (reference sources, media advertising and periodic literature); source of the energy problem; leadership role/community involvement; and personality characteristics of respondents (risk taker and compatability with beliefs/values). Respondents' demographic variables were age, education, occupation and income. The results are found in Table XII.

In reporting the results, the higher the value of the common variance for each two variables, the greater the strength of the association that exists between them. All correlation coefficients found in Table XII are significant, yet five have a high level of common variance that are worth noting: 1. innovative attitude and communication channels (77 percent); 2. innovative attitude and reference sources used (66 percent); 3. communication channels and reference sources (76 percent); 4. personality characteristics and risk taker (71 percent); and 5. personality characteristics and compatability with beliefs/values. In each instance, the relationships were positive with correlations above 0.80. Therefore, one's innovative attitude is influenced by the communication channels used to obtain information and, in particular, the reference sources. In addition, one's personality characteristics are indicated by a willingness to take risks and living harmoniously with one's beliefs/values.

TABLE XII

CORRELATION COEFFICIENTS AMONG INNOVATIVE ATTITUDES AND ITS RELATED FACTOR DIMENSIONS AND DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

	IA[1]	CC	PSI	ISI	RS	MA	PL	SEP	LR/CI	PC	RT	CB/V	A	E	O	I
Innovative Attitude (IA)		0.88****	0.48****		0.81****	0.32****	0.38****	0.24****	0.38****	0.61****	0.54****	0.49****				
Communication Channels (CC)			0.55****		0.87****	0.46****	0.47****		0.13*	0.32****	0.29****	0.26****				
Personal Sources of Information (PSI)					0.26****	0.29****	0.17**	-0.13*		0.14*		0.14*			0.12*	
Impersonal Sources of Information (ISI)																
Reference Sources (RS)							0.27****		0.18**	0.38****	0.36****	0.30****		0.18**		
Media Advertising (MA)							0.28****									
Periodic Literature (PL)												0.15*				
Source of Energy Problem (SEP)									-0.13**					-0.26****	0.14*	-0.26****
Leadership Role/Community Involvement (LR/CI)										0.23****	0.22***	0.18**		0.15**		
Personality Characteristics (PC)											0.84****	0.86****		0.15*		
Risk Taker (RT)												0.43****				
Compatability with Beliefs/Values (CB/V)														0.20***		
Age (A)															0.14*	0.16**
Education (E)															-0.41****	0.24****
Occupation (O)																-0.19***
Income (I)																

*=.05
**=.01
***=.001
****=.0001

[1] IA = Innovative Attitude; CC = Communication Channels; PSI= Personal Sources of Information; ISI = Impersonal Sources of Information; RS = Reference Sources; MA = Media Advertising; PL = Periodic Literature; SEP = Source of Energy Problem; LR/CI = Leadership Role/Community Involvement; PC = Personality Characteristics; RT = Risk Taker; CB/V = Compatability with Beliefs/Values; A = Age; E = Education; O = Occupation; I = Income.

The remaining correlation coefficients found in Table XII have a common variance of 37 percent or less. Respondents innovative attitude was positively related to personal sources of information with 23 percent of the common variance; media advertising (10 percent); periodic literature (14 percent); source of the energy problem (6 percent); leadership role/community involvement (14 percent); personality characteristics (37 percent); risk taker (29 percent); and compatability with beliefs/values (24 percent). Communication channels were found to be positively related to personal sources of information with 30 percent of the common variance; media advertising (21 percent); periodic literature (22 percent); leadership role/community involvement (2 percent); personality characteristics (10 percent); risk taker (8 percent); and compatability with beliefs/values (7 percent).

Personal sources of information were found positively related to reference sources with 7 percent of the common variance; media advertising (8 percent); periodic literature (3 percent); personality characteristics (2 percent); compatability with beliefs/values (2 percent); and occupation (1 percent). Personal sources of information were found negatively related to the source of the energy problem with a 2 percent common variance. Reference sources were found positively related to periodic literature with a 7 percent common variance; leadership role/community involvement (3 percent); personality characteristics (14

percent); risk taker (13 percent); compatability with beliefs/values (9 percent); and educational level of respondents (3 percent). Media advertising was found positively related to periodic literature with 8 percent of the common variance. Periodic literature was found positively related to compatability with beliefs/values with a 2 percent common variance.

Source of the energy problem was positively related to occupation with a 2 percent common variance while negatively related to leadership role/community involvement (2 percent); education (7 percent) and respondent's income (7 percent). Leadership role/community involvement was found postively related to personality characteristics with 5 percent of the common variance; risk taker (5 percent); compatability with beliefs/values (3 percent) and education (2 percent). Risk taker was positively related to compatability with beliefs/values with 18 percent of the common variance. Compatability with beliefs/values was found positively related to education with a 4 percent common variance.

Respondent's age was found positively related to occupation with a 2 percent common variance and to income level (3 percent). Education was found to be positively related to income with a 6 percent common variance and negatively related to occupation (17 percent). Occupation was found negatively related to the income level of

respondents with 4 percent of the common variance. The more professional the occupation, the more income.

The Chi-square statistics were used to test for significant relationships existing between the demographic characteristics and housing types. No significant relationships were found to exist between the variables sex, age, race, marital status, education or occupation and conventional/alternative dwellings or among conventional, solar and earth sheltered homes. A significant relationship at 0.0286 also was found between income levels and conventional or alternative dwelling types (see Tables XIII and XIV).

TABLE XIII

CHI SQUARE TEST OF INCOME BY CONVENTIONAL AND ALTERNATIVE DWELLING TYPES

Income	Conventional Dwellings	Alternative Dwellings	
To $19,999	2	10	12
$20,000 to $34,999	14	50	64
$35,000+	76	125	201
	92	185	277

Chi-Square = 7.106
DF = 2
Prob = 0.0286

TABLE XIV

CHI-SQUARE TEST OF INCOME BY CONVENTIONAL, SOLAR AND EARTH SHELTERED DWELLINGS

Income	Conventional Homes	Solar Homes	Earth Sheltered Homes	
To $19,999	2	1	9	12
$20,000 to $34,999	14	37	13	64
$35,000+	76	100	25	201
	92	138	47	277

Chi-Square = 36.383
DF = 4
Prob = 0.0001

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Introduction

In response to the escalation of utility rates for residential energy needs and a growing awareness of the limitations to worldwide fossil fuel supplies, solar and earth sheltered homes have been designed and built throughout the United States during the past decade. Results of studies indicate a substantial reduction in supplied energy sources can be obtained with these two alternative dwelling types. Future predictions foretell of continued price increases and the need to conserve energy resources. However, the total number of American consumers who have selected either a solar or earth sheltered home for their residence has been minimal.

In order to understand more fully where we are in the adoption process continuum, this study was undertaken to investigate the innovative attitudes of Oklahoma families who were living in solar or earth sheltered homes during the spring of 1983. A second group of Oklahoma families living in conventional dwellings was used for comparison purposes. Based upon a review of literature, the major categories

chosen to determine innovativeness were 1. communication channels used by respondents, 2. a perception of an energy problem, 3. one's leadership in the community, 4. characteristics of an innovation, and 5. demographic variables.

Data for this study were collected through a larger research project, S-141, "Housing for Low- and Moderate-Income Families," being conducted by the Southern Regional Housing Technical Committee. Specific objectives of this study were 1. to develop an instrument which would measure an innovative attitude, and 2. to validate that instrument so it could be used by the Southern Regional Housing Technical Committee in later investigations. Data were collected via a mailed structured questionnaire.

Factor analysis was used to assess the reliability of the 50 innovative attitude statements included in the questionnaire. The correlation matrices were factor analyzed by the Principal Axis Method with unity in the diagonals using the Factor Procedure of the Statistical Analysis System. Factoring was terminated when eigenvalues fell below 1.00. Factor matrices were rotated orthogonally using the Varimax rotation. An item was considered to load on a factor if it showed its highest loading on that factor and loaded at least 0.40.

Frequencies, percentages, means and standard deviation scores were calculated for all variables. F- and t-test statistics were utilized to test for significant differences

among mean scores. Analysis of variance and Duncan's Multiple-Range test were employed to assess mean differences among respondents from conventional, solar or earth sheltered dwellings. Pearson's product moment correlation analysis was used to determine the degree of relationship between innovative attitude, major and subfactor dimensions and demographic characteristics. The Chi-square test of significance was employed to identify the causal relationships between demographic characteristics and housing types. The results of these statistical tests are found in Chapter III and Chapter IV. A general discussion and considerations of those results follow.

Interpretation of Findings

The factor structure contained eight dimensions corresponding to four major categories: 1. communication channels, 2. source of the energy problem, 3. leadership role/community involvement, and 4. personality characteristics of respondents. These would form the basis of further analysis to determine an innovative attitude among respondents living in conventional, solar or earth sheltered homes. Demographic data were used to describe further the respondents in this study.

Results of previous research found a high correlation between socioeconomic status and innovativeness (i.e., subjects were better educated, wealthier and had

occupational prestige). Respondents who answered the questionnaire used in this study were predominantly white, married males who had attended or graduated from college and had occupations of a professional or technical nature. The mean age of respondents was 44 years. More than 70 percent of the respondents reported a minimum yearly income of $35,000. Sixty-six percent of the respondents reported their dwellings to be seven years old or less, and 76 percent of the respondents had lived in their homes for a period up to seven years. Over 75 percent of the homes in this study were between 1,501 and 3,000 square feet in size. Thus, as expected when controlling for the price and age of the sample of conventional homes selected for this study, a great similarity in socioeconomic status and among general housing conditions were found among respondents in this study irrespective of the family dwelling type.

Significant differences did occur, however, among the repondents in other areas being examined. Evidence compiled by Rogers (1983) indicated mass media channels of communication to be more important to early adopters than personal sources of information. The results of this study largely confirm this hypothesis. When examining the differences among respondents living in the three dwelling types, conventional home dwellers were more likely to use personal sources of information (i.e., friends, neighbors and relatives) than earth sheltered dwellers. The relationship among solar residents for this variable was not

clearly established. Therefore, on the basis of this single indicator, findings suggest that Oklahoma respondents living in earth sheltered homes are more innovative than conventional home dwellers.

A second major category related to the degree of innovativeness, the awareness of an energy problem, was examined in this study to determine if a relationship existed between the knowledge of a need to conserve finite natural resources and the adoption of an alternative housing type. The three energy related statements which clustered together consistently among respondents from all housing types dealt with the source of the problem being the result of oil and utility companies trying to make large profits or the "problem" being a part of a political scheme. According to the findings, the way in which one views the source of the energy problem was a function of one's race, education and yearly income level. A significant difference was found between respondents who were white, had attended or graduated from college and made a minimum yearly income of $35,000, and those respondents who were non-white with 12 years of education or less making up to $34,999 annually. These results again support previous empirical findings, indicating a relationship between high socioeconomic status and innovativeness (Rogers, 1983).

Researchers previously investigating the adoption process have found one's leadership role in the community to

be an indicator of a willingness to be the first to try an innovation (Rogers, 1983). Measuring one's leadership role and community involvement was thus selected as the third major variable to indicate an innovative attitude among respondents. In this study, a leadership role in the community correlated with one's high educational attainment. Those who had attended college, graduated, entered graduate school or obtained a graduate degree were found to be significantly different than those respondents having 12 years of education or less.

The fourth major category examined, personality characteristics, included statements which would indicate a respondent's willingness to take risks, and living a lifestyle that was compatible with their beliefs and values. As previously stated, an innovator is often described as venturesome and thus willing to explore many options in order to help solve a 'problem.' Again, significant differences were found based upon one's educational level. For the composite variable, Personality Characteristics, respondents who had attended college, a technical school or were college graduates were significantly different from respondents having a high school education or less. Such findings indicate one's willingness to take risks and living a lifestyle that is compatable with one's beliefs and values increases with education beyond the twelfth grade.

When measuring a willingness to take risks, white respondents and solar and earth sheltered home dwellers were

significantly different from non-white and conventional home dwellers. This finding supports previous innovation research results indicating white respondents and solar and earth sheltered respondents were more willing to take risks. Responses made by solar and earth sheltered home dwellers were also significantly different from conventional home dwellers' responses to statements included in the factor dimension, compatibility with beliefs and values. The implications from these findings indicate solar and earth sheltered home respondents perceived their personal contributions towards the energy conservation movement and their dwelling as being compatible with their beliefs and values.

In summarizing, it must be noted that the data findings reported in this paper were based upon the demographic characteristics of respondents and their Likert-scaled answers to thirty statements developed originally by the researcher to represent four aspects of the innovation diffusion research tradition previously described. The intent of this research investigation was to develop and validate an instrument that would measure the psychological trait innovativeness among solar and earth sheltered home dwellers. Factor analysis principal method with varimax rotation was utilized to meet this objective. The resulting factor dimensions did not yield the factors that were expected and in some cases, factors that were easily

identified. In some instances, new factor labels were assigned by the researcher (see Figure 2). Inferences were then made according to the factor name given to each new dimension.

Recommendations

Based on the findings of this study, the researcher makes the following observations and recommendations:

1. Greater efforts to publicize and educate the American population regarding their role in our energy future is warranted. This is deemed especially appropriate as conflicting statements continue to appear in the press and other media regarding the future availability of energy resources.
2. Information of an empirical nature is needed to further clarify the constraints encountered when adopting a solar or earth sheltered dwelling. The researcher chose to limit the statements specifically addressing these two housing types in preference to more general statements which would apply to all innovations. Therefore, the data revealed that respondents felt solar and earth sheltered homes were too complicated for most Americans but no further clarification was given by or requested of respondents. Such information would be helpful to housing professionals in the

areas of marketing, finance, policy formation and design, to name just a few. Areas that might be addressed are:

a. financing options
b. availability of competent builders/ contractors
c. working with protective covenants and other regulations affecting the design and building of alternative dwelling types
d. effects of the economy in general on housing decisions

3. Future investigations addressing the innovative attitudes of respondents living in alternative dwelling types might select subjects on the basis of particular demographic information. As an example, the majority of respondents in this study reported a minimum annual income of $35,000 (more than 70 percent). A future study might limit the income of respondents, study a specific age category or select subjects based upon their educational attainment.
4. Replication of this study in a different geographic location and with a larger sample size is needed for generalization purposes. It is also suggested that open-ended questions be included in

the instrument and that it be administered via a personal interview.

SELECTED BIBLIOGRAPHY

Ajzen, I. and M. Fishbein. "Understanding Attitudes and Predicting Social Behavior." In J. C. Brigham and L. S. Wrightsman (ed.), Contemporary Issues in Social Psychology. Monterey, CA: Brooks/Cole, 1982.

American Petroleum Institute. "Facts about Oil." In L. C.Ruedisili and M. W. Firebaugh (ed.), Perspectives on Energy, (2nd ed.). NY: Oxford University Press, 1979.

Anderer, J., A. McDonald and N. Nakicenovic. Energy in an Finite World. Cambridge, MA: Ballinger Pub. Co., 1981.

Anderson, B. The Solar Home Book. Andoner, MA: Brick House Pub. Co., Inc., 1976.

Babbie, E. The Practice of Social Research. Belmont, CA: Wadsworth Pub. Co., 1983.

Bainbridge, D., J. Corbett and J. Hofacre. Village Homes' Solar House Designs. Emmaus, PA: Rodale Press, 1979.

Bannon-Harwood, B. "Earth Shelters are Here to Stay." Concrete Construction, Sept. 1980, p. 647-651.

Barker, M. B. "Earth-sheltered construction: thoughts on public policy issues." Underground Space, 1980, 4(5):283-288.

Barrett, D., P. Epstein and C. M. Haar. Financing the Solar Home. Lexington, MA: Lexington Books, 1977.

Boyer, L. L., W. T. Grondzik and M. J. Weber. "Passive Energy Design and Habitability Aspects of Earth-Sheltered Housing in Oklahoma." Underground Space, 1980, 4(6):333-339.

Brown, L. A. Innovation Diffusion. NY: Methuen, 1981.

Clark, W. "Preface." (No title, introductory comments.) In: G. Coe, Office of Appropriate Technology, State of California. Present Value: Constructing a Sustainable Future. San Francisco: Friends of the Earth. 1979.

Clark, W. Energy for Survival. Garden City, NY: Anchor Books, 1974.

Coe, G. Office of Appropriate Technology, State of California. Present Value: Constructing a Sustainable Future. San Francisco: Friends of the Earth. 1979.

Coleman, J. "The Diffusion of an Innovation Among Physicians." Sociometry, 1957, 20:253-270.

Coleman, J. "Social Processes in Physicians' Adoption of a New Drug." Journal of Chronic Diseases, 1959, 9:1-19.

Coney, K. "Dogmatism and Innovation: A Replication." Journal of Marketing Research, Nov. 1972, 9:453-455.

Cozby, P. C. Methods in Behavioral Research. Palo Alto, CA: Mayfield Pub. Co., 1981.

Darley, J. M. and J. R. Beniger. "Diffusion of Energy-Conserving Innovations." Journal of Social Issues, 1981, 37(2):150-171.

Design Concept Associates. Homes in the Earth. San Francisco: Chronicle Books, 1980.

Donnelly, J. H., Jr. "Social Character and Acceptance of New Products." Journal of Marketing Research, February 1970, 7:111-113.

Donnelly, J. H. and M. J. Etyel. "Degrees of Product Newness and Early Trial." Journal of Marketing Research, August 1973, 10:295-300.

Farhar-Pilgrim, B. and C. T. Unseld. America's Solar Potential. NY: Praeger Publishers, 1982.

Federal Energy Administration. "The Energy Crisis: How Did it Happen?" Energy Reporter, December/January 1976-1977, 1-5.

Hirst, E. "Understanding Residential and Commercial Energy Conservation: The Need for Data." The Journal of Energy and Development, Autumn 1980, 6(1):86-108.

Hunt, V. D. Handbook of Conservation and Solar Energy. NY: Van Nostrand Reinhold Co., 1982.

Katz, E. "The Two-Step Flow of Communication: An Up-to-Date Report on an Hypothesis." Public Opinion Quarterly, 1957, 21:61-78.

Kerlinger, F. N. Foundations of Behavioral Research. NY: Holt, Rinehart & Winston, 1973.

Kirton, M. J. "Adaptors and Innovators in Culture Clash." Current Anthropology, September 1978, 19(3):611-612.

Kirton, M. J. "Adaptors and Innovators: A Description and Measure." Journal of Applied Psychology, 1976, 61(5): 622-629.

Koral, R. L. (ed.) Foundations for the Solar Future. Atlanta, GA: The Fairmont Press, Inc., 1981.

Korell, M. L. "Financing Earth Sheltered Housing: Issues and Opportunities." Underground Space, 1979, 3(6):297-301.

Kozak, M. R. "Energy Standards for New Buildings." Man, Society and Technology, March 1981, 8-12.

Kreider, J. F. The Solar Heating Design Process. NY: McGraw Hill Book Co., 1982.

Jacoby, J. "Personality and Innovation Proneness." Journal of Marketing Research, May 1971, 8:244-247.

Labay, D. G. and T. C. Kinnear. "Exploring the Consumer Decision Process in the Adoption of Solar Energy Systems." Journal of Consumer Research, 1981, 8(3): 271-278.

Labs, K. "The Architectural Underground." Underground Space, 1976, 1:1-8.

League of Women Voters. Energy Dilemmas: An Overview of U.S. Energy Problems and Issues. Washington, D.C.: League of Women Voters Educational Fund, 1977.

Leonard-Barton, D. "Voluntary Simplicity Lifestyles and Energy Conservation." Journal of Consumer Research, 1981, 8(3):243-252.

Lewin, K. "Group Decision and Social Change." In: H. Prochansky and B. Seidenberg (eds.) Basic Studies in Social Psychology. New York: Holt, Rinehart & Winston, p. 423-437, 1965.

Levy, D. I. "Solar Energy: Wave of the Future?" Journal of Property Management, July/August 1976, 151-154.

Mason, R. "Underground Architecture: What Lies Ahead May Be Beneath Us." The Futurist, February 1976, 16-20.

Mason, S. "Mortgage Finance for Alternative Housing." Earth Shelter Digest and Energy Report, Nov./Dec. 1979, 6:26-27.

Mazria, E. The Passive Solar Energy Book. Emmaus, PA: Rodale Press, 1979.

McGough, K. "The Housing Industry Goes Underground." California Real Estate, November 1980, 6-9.

McKown, C. and K. K. Stewart. "Consumer Attitudes Concerning Construction Features of an Earth-Sheltered Dwelling." Underground Space, 1980, 4(5):293-295.

Menzel, H. "Innovation, Integration and Marginality: A Survey of Physicians." American Sociological Review, 1960, 25:704-713.

Meyer, W. T. Energy, Economics and Building Design. New York: McGraw Hill, 1983.

Miller, D. C. Handbook of Research Design and Social Measurement. New York: David McKay Co., 1977.

Miller, G. T., Jr. Living in the Environment (3rd Ed.). Belmont, CA: Wadsworth Pub. Co., 1982.

Montgomery, R. H. The Solar Decision Book of Homes. NY: John Wiley & Sons, Inc., 1982.

Moreland, F. L. "Earth Covered Habit - An Alternative Future." Underground Space, 1977, 1:295-307.

National Research Council. Committee on Nuclear and Alternative Energy Systems. Energy in Transition 1985-2010. National Academy of Sciences, Washington, D.C. San Francisco: W. H. Freeman & Co. 1980.

Noland, M. C. "Solar Energy: Practice and Prognosis." In: M. Kranzberg, T. A. Hall and J. L. Scheiber (ed.), Energy and the Way We Live. San Francisco: Boyd Frazer. p. 359-372. 1980.

O'Neill, G. "Earth-like Space Colony." The Futurist, February 1976, 26-33.

Pedersen, P. O. "Innovative Diffusion Within and Between National Urban Systems." Geographical Analysis, July 1970, 2(3):203-54.

Raab, R. "Building Codes and Zoning Ordinance Affecting Earth-Sheltered Home Construction in N.Y. State." Underground Space, 1982, 7:110-114.

Reiger, A. J. "Appraising the Sun: Experience to Date." The Appraisal Journal, April 1980, 48(2):224-229.

Rivard, M. "How to Borrow the Money to Build Your Earth Sheltered Home." Earth Sheltered Digest & Energy Report, March/April 1979, 2:8-11.

Robertson, T. S. "The Process of Innovation and the Diffusion of Innovation." Journal of Marketing, Jan. 1967, 31:14-19.

Robinson, J. P. and P. R. Shaver. Measures of Social Psychological Attitudes. Ann Arbor, Michigan: Institute for Social Research, 1969.

Rogers, E. M. Diffusion of Innovations (3rd Ed.). New York: Free Press, 1983.

Rogers, E. M. and F. F. Shoemaker. Communication of Innovations: A Cross-Cultural Approach. NY: Free Press, 1971.

Rogers, E. M. and A. E. Havens. "Predicting Innovativeness." Sociological Inquiry, 1962, 32:34-42.

Rosenberg, N. "Factors Affecting the Diffusion of Technology." Exploration in Economic History, Fall 1972, 10:3-33.

Rudman, R. L. and C. G. Whipple. "Time Lag of Energy Innovation." EPRI Journal, April 1980, 5(3):14-20.

Schiffman, L. G. "Perceived Risk in New Product Trial by Elderly Consumers." Journal of Marketing Research, February 1972, 9:106-108.

Schiffman, L. G. and L. L. Kanuk. Consumer Behavior. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1978.

Schipper, L. and A. Ketoff. "Home Energy Use in Nine ODEC Countries, 1960-1980." Energy Policy, 1983, 11(2):131-147.

Scott, D. M. "The Earth Shelter Experience of Codes, Ordinances, Financing, Incentives and Attitudes." In: Proceedings of the Western Sun, 1980 Solar Update, Salt Lake City, Utah. p. 73-80.

Sersen, S. J. "Comparative Thermal Performance of Passive Systems in the National Solar Data Network (NSDN)." In: Proceedings of the Western Sun, 1980 Solar Update, Salt Lake City, Utah. p. 23-36.

Shama, A. "Energy Conservation in U.S. Buildings." Energy Policy, 1983, 11(2), p. 148-167.

Shama, A. "Speeding the Diffusion of Solar Energy Innovations." Energy, 1982, 7(8):705-715.

Shoemaker, R. W. and F. R. Shoaf. "Behavioral Changes in the Trial of New Products." Journal of Consumer Research, September 1975, 21:104-109.

Skurka, N. and J. Naar. Design for a Limited Planet. NY: Ballantine Books, 1976.

Southern Living, Inc. "What About Active Solar Energy?" In: The Future of the South, Home Environment. TVA's Solar Information Service. 1981.

Sterling, R. L. "Earth Sheltered Buildings: Construction, Activity and Research in the U.S." In: Proceedings of the Western Sun, 1980 Solar Update. Salt Lake City, Utah. p. 55-62.

Sterling, R. "Structural Systems for Earth Sheltered Housing." Underground Space, 1978, 3(2):72-81.

Stewart, K. and C. McKown. "Consumer Attitudes Concerning an Earth Sheltered House." Underground Space, 1979, 4(1):11-15.

Stobaugh, R. "After the Peak: The Threat of Hostile Oil." In: R. Stobaugh and D. Yergin, Energy Future. NY: Ballantine Books, 1980, p. 15-64.

Stobaugh, R. and D. Yergin. Energy Future. NY: Ballantine Books, 1980.

Sullivan, W. "Solar Energy: Still Decades Away?" In: M. Kranyberg, T. A. Hall and J. L. Scheiber, Energy and the Way We Live. San Francisco: Boyd & Fraser Pub. Co., p. 376-378, 1980.

Sunset Books and Sunset Magazine Editors. Solar Heating. Menlo Park, CA: Lane Pub. Co., 1979.

Teller, E. Energy From Heaven and Earth. San Francisco, W. H. Freeman & Co., 1979.

Theodorson, G. A. and A. G. Theodorson. A Modern Dictionary of Sociology. NY: Thomas Y. Crowell Co., 1969.

Tri-Arch Associates. The Earth Sheltered Handbook. Milwaukee, Wisconsin: Tech/Data Publications, 1980.

Underground Space Center, U. of Minnesota. Earth Sheltered Residential Design Manual. NY: Van Nostrand Reinhold, 1982.

Underground Space Center, U. of Minnesota. Earth Sheltered Community Design. New York: Van Nostrand Reinhold Co., 1981.

Underground Space Center, U. of Minnesota. Earth Sheltered Housing Design. NY: Van Nostrand Reinhold Co., 1979.

U.S. Congress, Senate, Energy Committee. The President's Energy Program: A Compilation of Documents. Washington, D.C.: U.S. Government Printing Office, 1977, p. 2-10.

U.S. Dept. of Housing & Urban Development, U.S. Dept. of Energy. Passive Solar Homes. NY: Facts on File, Inc., 1982.

U.S. Dept. of Housing & Urban Development. Office of Policy Development & Research. Energy Efficient Residence: Research Results. Washington, D.C.: U.S. Government Printing Office, September 1981.

Watson, D. (ed.). Energy Conservation Through Building Design. NY: McGraw-Hill Book Club, 1979.

White, L. A. The Concept of Cultural Systems. NY: Columbia Univ. Press, 1975.

Williams, S. and K. P. Larson. The Energy Event: Energy Efficient Housing of the Future. Cooperative Extension Service, Home Economics, Oklahoma State University, 1983.

Woods, M. C. "Energy from Sunlight." California Geology, January 1979, 32(1):12-18.

APPENDIX A

QUESTIONNAIRE

Section I.

1. **What type of energy related innovations does your house have?** (Check as many as apply)

		Date of Installation
___	1. Active solar collectors for space heating	_____
___	2. Active solar collectors for water heating	_____
___	3. Active solar collectors for swimming pools	_____
___	4. Passive solar design	_____
___	5. Earth sheltered	_____
___	6. Other, please explain _____	_____

_____

2. **How old is your housing/dwelling unit?**
   1. _____ years old

3. **How long have you lived in this house?** (Record actual number)
   1. _____ years

Section II: For each of the following statements respond to from strongly agree (5) to strongly disagree (1).

		Strongly Agree	Agree	Don't Know	Disagree	Strongly Disagree
1.	I believe I can contribute to the energy conservation movement.	5	4	3	2	1
2.	Based on the experience I have had while living in my home, I would recommend it to others.	5	4	3	2	1
3.	I would be willing to try a new product if it would save me money each month on utility bills.	5	4	3	2	1
4.	The average citizen influences the total amount of energy consumed in the United States each year.	5	4	3	2	1
5.	I like to be one of the first to try new products.	5	4	3	2	1
6.	I find difficult situations a challenge.	5	4	3	2	1
7.	Finding a mortgage for my home was difficult.	5	4	3	2	1
8.	I will proceed with a new idea to the point of dealing with involved professionals.	5	4	3	2	1
9.	Possible mechanical malfunctions would prevent me from purchasing a new product.	5	4	3	2	1
10.	I believe solar and earth sheltered homes are too complicated for most Americans.	5	4	3	2	1
11.	I choose my home to reflect my lifestyle.	5	4	3	2	1
12.	I prefer to look at issues based upon how they will effect me personally.	5	4	3	2	1
13.	If I see the advantage to adopting a more conservative lifestyle, I will do so.	5	4	3	2	1
14.	I prefer to test a new product prior to making a purchase.	5	4	3	2	1
15.	I am willing to try a new idea if it is within my budget.	5	4	3	2	1
16.	I can't truly believe in anything until I have personally experienced it.	5	4	3	2	1
17.	People come to me more often than I go to them for information.	5	4	3	2	1
18.	I enjoy sharing my new ideas with friends.	5	4	3	2	1
19.	Among my friends or neighbors, I am considered a good source of advice about political issues.	5	4	3	2	1

		Strongly Agree	Agree	Don't Know	Disagree	Strongly Disagree
20.	I am highly involved in civic and political issues.	5	4	3	2	1
21.	I often attend meetings where economic issues are discussed.	5	4	3	2	1
22.	In the past Americans have, in general, been wasteful in their use of natural resources.	5	4	3	2	1
23.	The oil companies in the United States are trying to make large profits.	5	4	3	2	1
24.	The utility companies in the United States are trying to make large profits.	5	4	3	2	1
25.	The United States is too dependent upon oil imported from foreign countries.	5	4	3	2	1
26.	The 1973-1974 Arab oil embargo caused the energy crisis in the United States.	5	4	3	2	1
27.	The world is running out of natural resources.	5	4	3	2	1
28.	The energy shortage is a part of a political scheme.	5	4	3	2	1
29.	Government price regulations have caused the energy crisis.	5	4	3	2	1
30.	The energy crisis is a worldwide problem, not just a problem in the United States.	5	4	3	2	1
31.	Science and technology have not kept pace with present energy needs.	5	4	3	2	1
32.	The shift away from the use of coal to the use of oil have caused the energy crisis.	5	4	3	2	1

		Definitely Helpful	Helpful	Don't Know	Not Helpful	Definitely Not Helpful
33.	When making a major purchase, how helpful are the following sources of information?					
	1. newspaper advertising	5	4	3	2	1
	2. newspaper articles	5	4	3	2	1
	3. magazine advertising	5	4	3	2	1
	4. magazine articles	5	4	3	2	1
	5. books	5	4	3	2	1
	6. radio advertising	5	4	3	2	1
	7. television advertising	5	4	3	2	1
	8. research journal articles	5	4	3	2	1
	9. "how-to-do-it" articles	5	4	3	2	1
	10. educational specialists	5	4	3	2	1
	11. manufacturer's representatives	5	4	3	2	1
	12. friends	5	4	3	2	1
	13. neighbors	5	4	3	2	1
	14. relatives	5	4	3	2	1
	15. consumer groups	5	4	3	2	1
	16. governmental agencies	5	4	3	2	1
	17. library	5	4	3	2	1
	18. trade or professional organizations	5	4	3	2	1

Section IV:

1. Demographic Data. Please fill in the information for each person in your home.

Sex	Age	Race	Marital Status	Education	Occupation
1. male 2. female	Enter your actual age	1. Afro-American 2. White 3. Hispanic 4. American Indian 5. Other	1. single 2. married 3. widowed, divorced or separated 4. Other	Enter the number of highest grade completed	Indicate the type of job you have (Indicate student, retired, homemaker, or other if not gainfully employed)
Example 1 (male)	27 (age)	3 (Hispanic)	2 (married)	16 (college)	Manager - TG&Y
Respondent					
Spouse					
Children					
Others					

2. Which of these broad categories describes your total family income before taxes in 1982?

___ 1. Less than $5,000
___ 2. $5,000 to $9,999
___ 3. $10,000 to $14,999
___ 4. $15,000 to $19,999
___ 5. $20,000 to $24,999
___ 6. $25,000 to $29,999
___ 7. $30,000 to $34,999
___ 8. $35,000 to $39,999
___ 9. $40,000 or more

APPENDIX B

PILOT QUESTIONNAIRE

I. Please respond to the following sources of information by checking one of the categories on the right, DEFINITELY HELPFUL (5) to DEFINITELY NOT HELPFUL (1).

	Definitely Helpful	Helpful	Don't Know	Not Helpful	Definitely Not Helpful
a. newspaper advertising	5	4	3	2	1
b. newspaper articles	5	4	3	2	1
c. magazine advertising	5	4	3	2	1
d. magazine articles	5	4	3	2	1
e. books	5	4	3	2	1
f. radio advertising	5	4	3	2	1
g. television advertising	5	4	3	2	1
h. research journal articles	5	4	3	2	1
i. "how-to-do-it" articles	5	4	3	2	1
j. educational specialists	5	4	3	2	1
k. manufacturer's representatives	5	4	3	2	1
l. friends, relatives, neighbors	5	4	3	2	1

II. Please respond to each of the following statements by checking one of the categories on the right, STRONGLY AGREE (5) to STRONGLY DISAGREE (1).

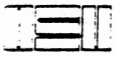
	Strongly Agree	Agree	Don't Know	Disagree	Strongly Disagree
1) People come to me more often than I go to them for information.	5	4	3	2	1
2) I enjoy sharing my new ideas with friends.	5	4	3	2	1
3) Among my friends or neighbors, I am considered a good source of advice about political issues.	5	4	3	2	1
4) I am highly involved in civic and political activities.	5	4	3	2	1
5) I often attend meetings where economic issues are discussed.	5	4	3	2	1
6) In the past Americans have, in general, been wasteful in their use of natural resources.	5	4	3	2	1

	Strongly Agree	Agree	Don't Know	Disagree	Strongly Disagree
7) The oil companies in the United States are trying to make greater profits.	5	4	3	2	1
8) The utility companies in the United States are trying to make greater profits.	5	4	3	2	1
9) The United States is too dependent upon oil imported from foreign countries.	5	4	3	2	1
10) The 1973-74 Arab oil embargo caused the energy crisis in the United States.	5	4	3	2	1
11) The world is running out of natural resources.	5	4	3	2	1
12) The energy shortage is a part of a political scheme.	5	4	3	2	1
13) Government price regulations have caused the energy crisis.	5	4	3	2	1
14) The energy crisis is a worldwide problem, not just a problem in the United States.	5	4	3	2	1
15) Science and technology have not kept pace with present energy needs.	5	4	3	2	1
16) The shift away from the use of coal to the use of oil has caused the energy crisis.	5	4	3	2	1
17) I believe I can contribute to the energy conservation movement.	5	4	3	2	1
18) Based on the experience I have had while living in my home, I would recommend it to others.	5	4	3	2	1
19) I would be willing to try a new product if it would save me money each month on utility bills.	5	4	3	2	1
20) The average citizen influences the total amount of energy consumed in the United States each year.	5	4	3	2	1
21) I like to be one of the first to try new products.	5	4	3	2	1

	Strongly Agree	Agree	Don't Know	Disagree	Strongly Disagree
22) I find difficult situations a challenge.	5	4	3	2	1
23) Finding a mortgage for my home was difficult.	5	4	3	2	1
24) I will proceed with a new idea to the point of dealing with involved professionals.	5	4	3	2	1
25) Possible mechanical malfunctions would prevent me from purchasing a new product.	5	4	3	2	1
26) I believe solar and earth sheltered homes are too complicated for most Americans.	5	4	3	2	1
27) I choose my home to reflect my lifestyle.	5	4	3	2	1
28) I prefer to look at issues based upon how they will effect me personally.	5	4	3	2	1
29) If I see the advantage to adopting a more conservative lifestyle, I will do so.	5	4	3	2	1
30) I prefer to test a new proeuct prior to making a purchase.	5	4	3	2	1
31) I am willing to try a new idea if it is within my budget.	5	4	3	2	1
32) I can't truly believe in anything until I have personally experienced it.	5	4	3	2	1

APPENDIX C

LETTERS TO SUBJECTS



Oklahoma State University

COLLEGE OF HOME ECONOMICS
Department of Housing, Design and Consumer Resources

STILLWATER, OKLAHOMA 74078
HOME ECONOMICS WEST BUILDING
(405) 624-5048

The Department of Housing, Design and Consumer Resources at Oklahoma State University is conducting a study relating to housing and energy. Of particular interest are innovative types of home; active and passive solar and earth sheltered housing. This research project is part of a Southern Regional Project which consists of ten to twelve states that are studying attitudes related to alternative housing.

Enclosed is a questionnaire that has four major parts to it. 1) Present Housing - specific kinds of information about your housing unit. 2) Innovation and Acceptance - your concept of innovativeness. 3) Aesthetic perception of the home unit. 4) Demographics - basic information about your family. We would like you to take 30-40 minutes and fill out this questionnaire for us. You will remain anonymous - no name is connected with the information. This information will help us as we assess different types of housing forms and the kinds of attitudes that people have who are living in these forms.

A study concerned with people's attitudes toward alternative housing was conducted a year ago and mailed to people throughout the state of Oklahoma living in conventional housing. We would like to compare these attitudes with the attitudes of people actually living in the alternative housing forms.

We would be glad to send you information once the project is completed about the kinds of responses that we receive (a summary of the research) and we would anticipate this research being completed by mid to end of summer. Would you please complete the questionnaire and send it back by April 15.

Again, thank you for participating in this research project. If you should have any questions about the questionnaire or about the research in general, we would be happy to answer any of these questions. Please feel free to contact me at Oklahoma State University.

Sincerely yours,

Margaret Weber

Dr. Margaret Weber
Associate Professor

Oklahoma State University

COLLEGE OF HOME ECONOMICS
Department of Housing, Design and Consumer Resources

STILLWATER, OKLAHOMA 74078
HOME ECONOMICS WEST BUILDING
(405) 624-5048

A couple weeks ago a questionnaire seeking answers about the type of housing that you are now living in, was mailed to you. Your name was chosen from listings of architects and builders that are involved in the area of construction of energy efficient housing.

If you have already completed and returned the questionnaire, please accept our sincere thanks. If not, could you please do so today because the questionnaire has been sent to only a small but representative sample of residents in alternative housing, it is extremely important that yours be included in the study if the results are to accurately represent the opinions of people living in alternative housing.

If by some chance you did not receive the questionnaire or it was misplaced, please call me and I will get another one in the mail to you today.

Sincerely,

Margaret Weber

Margaret Weber, Project Director
Associate Professor

APPENDIX D

TABLES

TABLE XV

ROTATED FACTOR PATTERN BY TOTAL SAMPLE AND CONVENTIONAL, SOLAR AND EARTH SHELTER DWELLINGS

Total Sample		Conventional Homes		Solar Homes		Earth Sheltered Homes	
Factor Descriptors	Loading	Factor Descriptors	Loading	Factor Descriptors	Loading	Factor Descriptors	Loading
1 REFERENCE SOURCES		REFERENCE SOURCES		REFERENCE SOURCES		REFERENCE SOURCES	
Books	.66	1 Books	.75	1 Books	.77	1 Books	.70
Research Journals	.73	1 Research Journals	.65	1 Research Journals	.74	1 Research Journals	.77
"How-to-do-it" Articles	.64	1 "How-to-do-it" Articles	.52	1 "How-to-do-it" Articles	.62	1 "How-to-do-it" Articles	.67
Educational Specialists	.67	1 Educational Specialists	.66	1 Educational Specialists	.69	1 Educational Specialists	.77
Manufacturer's Representatives	.49	2 Manufacturer's Representatives	.54	1 Manufacturer's Representatives	.46	10 Manufacturer's Representatives	
Consumer Groups	.60	6 Consumer Groups	.74	1 Consumer Groups	.54	1 Consumer Groups	.57
Governmental Agencies	.63	6 Governmental Agencies	.74	1 Governmental Agencies	.69	1 Governmental Agencies	.63
Library	.77	1 Library	.69	1 Library	.81	1 Library	.88
Trade or Professional Organizations	.66	1 Trade or Professional Organizations	.45	1 Trade or Professional Organizations	.51	1 Trade or Professional Organizations	.51
2 PERSONAL COMMUNICATION NETWORK		PERSONAL COMMUNICATION NETWORK		PERSONAL COMMUNICATION NETWORK		PERSONAL COMMUNICATION NETWORK	
Friends	.85	4 Friends	.89	2 Friends	.80	3 Friends	.85
Neighbors	.86	4 Neighbors	.87	2 Neighbors	.84	3 Neighbors	.90
Relatives	.80	4 Relatives	.67	2 Relatives	.82	3 Relatives	.79
3 MEDIA ADVERTISING		MEDIA ADVERTISING		MEDIA ADVERTISING		MEDIA ADVERTISING	
Newspaper Advertising	.74	2 Newspaper Advertising	.74	3 Newspaper Advertising	.57	2 Newspaper Advertising	.62
Radio Advertising	.84	2 Radio Advertising	.79	3 Radio Advertising	.86	2 Radio Advertising	.72
Television Advertising	.85	2 Television Advertising	.82	3 Television Advertising	.87	2 Television Advertising	.85

TABLE XV (Continued)

Total Sample			Conventional Homes			Solar Homes			Earth Sheltered Homes		
Factor	Descriptors	Loading	Factor	Descriptors	Loading	Factor	Descriptors	Loading	Factor	Descriptors	Loading
4	COMPATABILITY WITH BELIEFS/VALUES			COMPATABILITY WITH BELIEFS/VALUES			COMPATABILITY WITH BELIEFS/VALUES			COMPATABILITY WITH BELIEFS/VALUES	
	I believe I can contribute to the energy conservation movement.	.82	7	I believe I can contribute to the energy conservation movement.	.82	8	I believe I can contribute to the energy conservation movement.	.75	4	I believe I can contribute to the energy conservation movement.	.61
	Based on the experience I have had while living in my home, I would recommend it to others.	.63	7	Based on the experience I have had while living in my home, I would recommend it to others.	.67	9	Based on the experience I have had while living in my home, I would recommend it to others.	.80	4	Based on the experience I have had while living in my home, I would recommend it to others.	.83
	The average citizen influences the total amount of energy consumed in the United States each year.	.62	7	The average citizen influences the total amount of energy consumed in the United States each year.	.66	8	The average citizen influences the total amount of energy consumed in the United States each year.	.79	4	The average citizen influences the total amount of energy consumed in the United States each year.	.44
	I believe solar and earth sheltered homes are too complicated for most Americans.	.51	10	I believe solar and earth sheltered homes are too complicated for most Americans.	.86	5	I believe solar and earth sheltered homes are too complicated for most Americans.	.37	4	I believe solar and earth sheltered homes are too complicated for most Americans.	.50

TABLE XV (Continued)

Total Sample			Conventional Homes			Solar Homes			Earth Sheltered Homes		
Factor	Descriptors	Loading	Factor	Descriptors	Loading	Factor	Descriptors	Loading	Factor	Descriptors	Loading
5	LEADERSHIP ROLE/COMMUNITY INVOLVEMENT			LEADERSHIP ROLE/COMMUNITY INVOLVEMENT			LEADERSHIP ROLE/COMMUNITY INVOLVEMENT			LEADERSHIP ROLE/COMMUNITY INVOLVEMENT	
	Among my friends or neighbors, I am considered a good source of advice about political issues.	.78	3	Among my friends or neighbors, I am considered a good source of advice about political issues.	.77	4	Among my friends or neighbors, I am considered a good source of advice about political issues.	.79	8	Among my friends or neighbors, I am considered a good source of advice about political issues.	.86
	I am highly involved in civic and political issues.	.89	3	I am highly involved in civic and political issues.	.90	4	I am highly involved in civic and political issues.	.89	7	I am highly involved in civic and political issues.	.60
	I often attend meetings where economic issues are discussed.	.80	3	I often attend meetings where economic issues are discussed.	.89	4	I often attend meetings where economic issues are discussed.	.89	7	I often attend meetings where economic issues are discussed.	.83
6	SOURCE OF ENERGY PROBLEM			SOURCE OF ENERGY PROBLEM			SOURCE OF ENERGY PROBLEM			SOURCE OF ENERGY PROBLEM	
	The oil companies in the U.S. are trying to make large profits.	.90	5	The oil companies in the U.S. are trying to make large profits.	.91	6	The oil companies in the U.S. are trying to make large profits.	.87	6	The oil companies in the U.S. are trying to make large profits.	.77
	The utility companies in the U.S. are trying to make large profits.	.88	5	The utility companies in the U.S. are trying to make large profits.	.89	6	The utility companies in the U.S. are trying to make large profits.	.86	6	The utility companies in the U.S. are trying to make large profits.	.73
	The energy shortage is part of a political scheme.	.65	5	The energy shortage is part of a political scheme.	.50	6	The energy shortage is part of a political scheme.	.64	6	The energy shortage is part of a political scheme.	.59

TABLE XV (Continued)

Total Sample			Conventional Homes			Solar Homes			Earth Sheltered Homes		
Factor	Descriptors	Loading	Factor	Descriptors	Loading	Factor	Descriptors	Loading	Factor	Descriptors	Loading
7	PERIODIC LITERATURE			PERIODIC LITERATURE			PERIODIC LITERATURE			PERIODIC LITERATURE	
	Newspaper Articles	.80	8	Newspaper Articles	.79	7	Newspaper Articles	.86	5	Newspaper Articles	.81
	Magazine Articles	.77	8	Magazine Articles	.55	7	Magazine Articles	.75	5	Magazine Articles	.75
8	RISK TAKER			RISK TAKER			RISK TAKER			RISK TAKER	
	I would be willing to try a new product if it would save me money each month on utility bills.	.64	9	I would be willing to try a new product if it would save me money each month on utility bills.	.74	5	I would be willing to try a new product if it would save me money each month on utility bills.	.70	4	I would be willing to try a new product if it would save me money each month on utility bills.	.75
	I like to be one of the first to try new products.	.73	9	I like to be one of the first to try new products.	.80	5	I like to be one of the first to try new products.	.62	4	I like to be one of the first to try new products.	.50
	I find difficult situations a challenge.	.65	3	I find difficult situations a challenge.	.36	5	I find difficult situations a challenge.	.73	8	I find difficult situations a challenge.	.86

TABLE XVI

T-TEST OF INNOVATIVE ATTITUDE FACTOR DIMENSIONS BY SEX

Dimension	Descriptor	N	Mean	S.D.	T
Innovative Attitude	Male	199	108.69	10.76	0.72
	Female	57	107.51	11.74	
Communication Channels	Male	206	61.78	8.15	0.44
	Female	62	61.26	8.20	
Personal Sources of Information	Male	217	11.23	2.16	-0.47
	Female	66	11.36	1.77	
Impersonal Sources of Information	Male	213	34.16	4.65	1.07
	Female	65	33.45	5.07	
Reference Sources	Male	209	32.55	5.85	1.32
	Female	62	31.40	6.49	
Media Advertising	Male	216	10.24	2.57	0.12
	Female	66	10.20	2.67	
Periodic Literature	Male	219	7.80	1.28	-0.20
	Female	67	7.84	1.43	
Source of Energy Problem	Male	217	10.35	2.92	-0.68
	Female	68	10.59	2.33	
Leadership Role/Community Involvement	Male	215	7.99	2.71	1.50
	Female	67	7.42	2.70	
Personality Characteristics	Male	211	28.52	3.56	1.36
	Female	61	27.80	3.84	
Risk Taker	Male	216	11.57	2.05	1.44
	Female	63	11.08	2.20	
Compatability with Beliefs/Values	Male	212	17.01	2.13	1.42
	Female	64	16.56	2.43	

TABLE XVII

F-TEST AND DUNCAN'S MULTIPLE COMPARISON TEST FOR INNOVATIVE ATTITUDE RELATED FACTOR DIMENSIONS BY AGE

Dimension/Descriptors	N	Mean	F	Duncan's[a]
Communication Channels				
56+ years	62	62.82	0.60	A
26-35 years	71	61.72		A
36-55 years	124	61.46		A
Source of Energy Problem				
26-35 years	73	10.71	2.25	A
36-55 years	127	10.59		A
56+ years	72	9.85		A
Leadership Role/Community Involvement				
56+ years	71	8.24	0.80	A
26-35 years	72	7.86		A
36-55 years	127	7.72		A
Personality Characteristics				
26-35 years	71	28.47	0.03	A
56+years	65	28.42		A
36-55 years	125	28.33		A

[a]Means with the same letter are not significantly different.

TABLE XVIII

T-TEST OF INNOVATIVE ATTITUDE FACTOR DIMENSIONS BY MARITAL STATUS

Factor Dimension	Descriptor	N	Mean	S.D.	T
Innovative Attitude	Married	238	108.66	11.31	0.77
	Not Married	20	107.30	7.18	
Communication Channels	Married	250	61.70	8.33	-0.21
	Not Married	20	62.10	5.93	
Personal Sources of Information	Married	263	11.26	2.10	-0.32
	Not Married	22	11.41	1.84	
Impersonal Sources of Information	Married	259	33.98	4.82	-0.68
	Not Married	21	34.71	3.91	
Reference Sources	Married	253	32.31	6.13	-0.14
	Not Married	20	32.50	4.26	
Media Advertising	Married	262	10.22	2.58	-0.65
	Not Married	22	10.59	2.72	
Periodic Literature	Married	265	7.81	1.33	-0.22
	Not Married	23	7.87	1.10	
Source of Energy Problem	Married	264	10.40	2.78	-0.27
	Not Married	23	10.57	2.90	
Leadership Role/Community Involvement	Married	262	7.92	2.75	0.61
	Not Married	22	7.55	2.76	
Personality Characteristics	Married	253	28.42	3.61	0.86
	Not Married	21	27.71	3.84	
Risk Taker	Married	259	11.44	2.06	0.35
	Not Married	22	11.27	2.35	
Compatability with Beliefs/Values	Married	257	16.95	2.17	1.23
	Not Married	21	16.33	2.59	

TABLE XIX

F-TEST AND DUNCAN'S MULTIPLE COMPARISON TEST FOR INNOVATIVE ATTITUDE RELATED FACTOR DIMENSIONS BY OCCUPATION

Dimension/Descriptors	N	Mean	F	Duncan's[a]
Communication Channels				
Non-Prof./Service	62	62.61	0.65	A
Retired	17	62.24		A
Housewife	26	61.73		A
Prof./Technical	157	61.41		A
Farm/Farm Manager	6	57.50		A
Source of Energy Problem				
Retired	21	11.10	2.31	A
Non-Prof./Service	68	11.09		A
Farm/Farm Manager	7	10.86		A
Housewife	28	10.61		A
Prof./Technical	161	10.00		A
Leadership Role/Community Involvement				
Prof./Technical	160	8.16	1.13	A
Housewife	27	7.81		A
Non-Prof./Service	68	7.49		A
Retired	20	7.35		A
Farm/Farm Manager	7	7.00		A
Personality Characteristics				
Retired	19	28.84	1.09	A
Prof./Technical	157	28.62		A
Housewife	25	28.28		A
Non-Prof./Service	65	27.79		A
Farm/Farm Manager	6	26.50		A

[a]Means with the same letter are not significantly different.

VITA

Phyllis Adams Marcus

Candidate for the Degree of

Doctor of Philosophy

Thesis: EVALUATION OF INNOVATIVENESS AS A FACTOR IN THE ADOPTION OF ENERGY EFFICIENT HOUSING ALTERNATIVES

Major Field: Home Economics - Housing, Interior Design and Consumer Studies

Biographical:

Personal Data: Born and raised in San Francisco, California; daughter of David K. and Fay L. Adams; mother of Susan Patricia, Brian David and Stanley Thomas Jones.

Education: Received Bachelor of Arts, Summa Cum Laude, in Home Economics/Housing and Interior Design from San Francisco State University in 1973; received Master of Arts in Home Economics/Housing, Interior Design and Urban Studies from San Francisco State University in 1975; completed requirements for the Doctor of Philosophy degree in Home Economics/ Housing, Interior Design and Consumer Studies at Oklahoma State University in December, 1983.

Professional Experience: Research Associate, Department of Housing, Interior Design and Consumer Studies, Oklahoma State University, 1981-1983; State Director, Home Economics Inservice Education, Vea Supbart 3 and Subpart 5 Projects, Redwood City, California, 1979-1981; Principal, Phyllis A. Marcus, Design Consultant, Commercial and Residential Environments, 1976-1981, Palo Alto, California; Lecturer, Department of Home Economics, San Francisco State University, 1975-1981; Lecturer, Department of Home Economics, San Jose State University, San Jose, California, 1977-1980; Lecturer, Department of Home Economics, Soland Community College, Suisun City, California,

1976; Lecturer, Department of Home Economics, Skyline College, San Bruno, California, 1975-1977.

Professional Affiliations: American Association of Housing Educators; American Association of University Women; American Home Economics Association; American Planning Association; Environmental Design Research Association; National Association of Housing and Redevelopment Officials; National Council of Math/Science Educators; National Homebuilders Association; Omicron Nu; Phi Delta Kappa.