

Marketing Transportation Technology and Programs

RAY G. GRIFFITH AND MARTHA M. SONEIRA

The road and transportation industry in the United States has a long history of seeking out new and innovative technology for the developing transportation infrastructure. Active federal support for the improvement of transportation systems dates from the late 19th century. Assistance from the federal government facilitated access to new technologies and created opportunities for assimilation. Early-model programs of technology demonstration, technical assistance, and training have remained effective tools of technology transfer to the highway community 100 years later. New strategies are required, however, to keep pace with the increasing rate at which new technology and products have become available. In 1990, the Federal Highway Administration defined a marketing process through which highway programs and technologies could be more effectively developed, promoted, implemented, and deployed. The marketing approach incorporates user needs, attitudes, and perceptions into development of new research products. Successful promotion and timely deployment of innovative technology and programs are also dependent on the interest and participation of our partners in the highway community. An historic overview of highway technology transfer in the United States and a description of the evolving marketing program designed to enhance the process are provided. It has been found that successful technology transfer depends on the involvement and support of partners in the domestic and international highway community who help shape the highway program throughout the marketing process.

The prosperity of our nation has depended on the progressive evolution of its transportation infrastructure: a product of partnerships, both private and public, and application of proven technology, both national and international. From the early roads that used successful European pavement techniques, to the sophisticated ribbons of interstate highways built with cooperative effort, the American transportation system reflects an evolution of federal and state roles and application of innovative technology from a multitude of sources.

Early federal involvement in transportation helped the economy grow by linking commercial activities of the states. Thomas Jefferson signed the first federal highway program into law in 1806, creating the National Road (now called U.S. Route 40 in upper Maryland), which connected Ohio to the Eastern seaboard (1, p. 1).

The United States led the "turnpike movement" (2, p. 11), coordinating the construction of privately financed public works to link up with the National Road. Development of this early road network captivated European interest and investment capital as well as U.S. dollars. States worked cooperatively with each other and private firms to operate toll roads in support of road maintenance.

Office of Technology Applications, Federal Highway Administration, U.S. Department of Transportation, 400 7th St., S.W., Room #6322, Washington, D.C. 20590.

Although early highway programs were mostly state functions, a few forms of federal assistance were in place in the 19th century. Federal troops opened up the Western Territories with primitive roads. The federal government also granted free right-of-way for state public roads over unreserved public lands.

The Good Roads Movement of the 1890s shaped the role of state aid for roads and pressured Congress to define a measure of federal assistance. As a result, the Office of Road Inquiry was established in 1893. Throughout this scenario, the focus had been "farm-to-market," dealing with agricultural concerns and rural roads. The new office, within the U.S. Department of Agriculture, collected and disseminated information on roads, primarily serving in an educational and promotional capacity. Later responsibilities expanded to include "object lesson roads," which demonstrated successful road construction techniques, and experimental roads, on-site assistance, and training.

It soon became evident that an enormity of road problems needed to be addressed on a national level. The Federal-Aid Road Act of 1916 addressed the growing responsibilities of road-builders beyond construction: considerations of the economy, social and cultural needs, the environment, natural resources, and international relations, where appropriate (2, p. 202).

The Bureau of Public Roads, as it was called in 1919, established its role as one of encouragement, leadership, and protection of the national interest. The newly formed American Association of State Highway Officials (AASHO) complemented this role in partnership with federal efforts, consulting on highway construction, legislation, and state issues.

The need for a national program of highway research was addressed through the Highway Research Board (later named the Transportation Research Board). The program coordinated activities in industry, academia, and other organizations for dissemination of information about research to the highway community. These early believers in the open discussion of research also recognized that technical information is "of no value to anyone unless it is learned and put to use by the technical man (2, p. 209)."

As the automobile revolutionized transportation technology, the thrust of highway technology shifted along with the population to address concerns of urban centers. A new vision focused on developing a highway system to improve national defense capabilities and link the network of manufacturing centers.

With an increased pace of technological innovation came a greater demand for specialized knowledge and skills. The highway program expanded, interacting with other federal programs and the general public.

Among the significant actions in the Federal-Aid Highway Act of 1956 was development of the Interstate Highway System under the jurisdiction and guidance of the Bureau of Public Roads, then in the Department of Commerce. As the Interstate construction program got under way, the Federal Highway department decentralized for more effective local project management. The interstate system is nearing completion under stewardship of FHWA within the Department of Transportation.

The end of the Interstate construction era provides an opportunity to redirect the focus of FHWA activities and define its leadership role in disseminating transportation technology. An era of system development has been replaced by an era of system performance (T. Larson, unpublished data, FHWA, 1991). The mature highway system now requires preservation, improvement, and enhancement. Increased motor carrier activity and a growing commuter public contribute to congestion, pollution, and loss of economic productivity. The National Transportation Policy (3) addresses these issues and proposes new strategies for the 21st century. Budget restraints and deficit reduction, changing demographics, and the urge to innovate are driving future actions. The policy reaches beyond the traditional role of the federal government to involve all parties with a vested interest in transportation and quality of life—state and local governments, academic institutions, the private sector, and the driving public—to work together to improve the safety and efficiency of our transportation system.

The FHWA plays a significant role in the mission to improve the transportation system and to revitalize the domestic economy through its programs of highway research, development, and technology transfer. FHWA has the opportunity to participate in activities of the international highway community, bringing the best of foreign technology and techniques to the United States. A marketing approach not only directs research and refines product development but also enhances the process of technology transfer through strategic planning of activities.

FHWA TECHNOLOGY TRANSFER PROGRAM

Technology transfer is the sum of activities by technology sponsors, developers, and users leading to the adoption of a product or procedure (4, p. 1). The traditional technology transfer program starts with a research product or program and develops a strategy of delivery to the appropriate user in the highway community. The program defines potential users, barriers, opportunities, and tools for moving technology from the implementer to the user. FHWA has successfully used its technology transfer program since the 1970s to link technologies and procedures with practical applications in the highway community. Services included hands-on demonstrations, workshops, technical assistance, special studies, and training courses. Other support included distribution of manuals, films, and tapes to appropriate personnel at the state level and development of technical procedures and guidelines. Technology transfer specialists coordinated activities at the regional and division levels and used personal contact as the strategy for successful communication.

However, one-to-one contact is not always an appropriate tactic at every level of the transfer process. Effective transfer is complicated because of the multijurisdictional nature of the highway industry and the need to transfer this technology to users at various levels (5, p. 2). Various groups with distinct capabilities, responsibilities, and agendas require a range of unique technology transfer activities. Highway programs often need political visibility and benefit from participation in cooperative activities with highway organizations to rally public support.

A program review study (6, p. 7) found that many useful products coming out of research studies were items not predicted in early stages of research. Oftentimes these new products or solutions to problems were lost by the inability to move them out of the laboratory and into use. The 1990 FHWA report, "Marketing Highway Technology and Programs," established a marketing process by which FHWA could more effectively develop, promote, and implement these useful highway products and programs.

A MARKETING PHILOSOPHY

Marketing involves an exchange of values that can be tangible, such as money exchanged for groceries, or intangible, such as the use of seat belts exchanged for passenger safety. To understand how marketing applies to government technology transfer, it helps to explain its evolution as a business philosophy (7, p. 37). Business management can be distinguished by four orientations that evolved during significant economic eras in the United States.

A product orientation follows the "better mousetrap" theory: that the major task of an organization is to put out products perceived as good for the public. The public may not need or want a better mousetrap or an Edsel automobile, for that matter. The producer is confident that the product meets the company objectives and does not feel obligated to modify the product to meet customer needs. Historically, this product orientation developed at the turn of the century and highlighted such great products as the electric light, the radio, and the automobile.

According to this approach, research done "for the sake of research" is justified because it creates new knowledge (8): "If the knowledge is there a use will be found for it." A product not developed for a specific purpose leads to an ad hoc process of technology transfer, with a product searching for a user.

A production orientation focuses on efficiencies in production and distribution within an organization. Innovations in service and assembly-line production (exemplified by Henry Ford and his first automobiles) often bent the needs of the consumer to fit the system. "You can get this automobile in any color as long as it's black" reflects assembly-line thought. This philosophy is reflected in some government technology transfer efforts as well. To get a new technology in use on the highway, sometimes a product is released before it is thoroughly tested and evaluated. Hot thermoplastic pavement striping is an example of a highway technology not fully developed before release. Although demonstration test sections were already being applied, it was found that further refine-

ments to application techniques needed to be made for proper performance. Giving a new product such a false start creates a skepticism about the value of future improvements.

A sales orientation is often mistaken for a marketing approach. It centers on using persuasion techniques to push a particular product or technology through advertising or personal salesmanship. This approach developed in the Depression era of the 1930s when production exceeded demand. With a glut of mass-produced items on the market, the key to company success (or survival) was salesmanship: convincing the consumer to buy its product over that of a competitor. The term "Madison Avenue approach" is used often to convey a less-than-flattering image of aggressive sales tactics and advertising.

This philosophy goes against the grain of traditional government thought (typically product-oriented), which supports the notion that a useful product sells itself without resorting to glitzy promotion. But good salesmanship is one characteristic of an effective technology transfer agent that is emphasized in FHWA literature on successful technology transfer (5, p.8). An outgoing personality and ability to network with the right users are still important and valid characteristics.

A customer, or market, orientation can alleviate the need for aggressive sales tactics. As the U.S. economy rebounded in the 1950s, consumer wealth increased. The demand for high-quality products grew and consumers no longer settled for products pushed on them. This "consumer-centered" philosophy is evident in promotional campaigns for airlines ("the friendly skies") and in improvements in service (solicitous sales personnel at Nordstrom's retail stores).

This systematic study of customer needs, wants, and perceptions can be applied to technical innovation activities in the highway and transportation community. By determining user needs early in the research process and developing the product around those needs, a technology can sell itself to the right users. The product format, promotion and style will be appropriate because these are geared to benefit a particular segment of the user community.

Marketing Highway Technology

A restructured approach to technology transfer was formulated through extensive outreach to the highway community and coordinated by FHWA. Four premises frame the actions of this program (9). First, both public and private highway agencies must commit resources to develop and evaluate innovative research and technology in a timely manner. Marketing techniques can streamline this technology transfer process, proving the commitment of personnel, funding, and equipment to be a cost-effective investment.

Second, marketing techniques must be incorporated into the program activities of FHWA. Employees involved in product development and outreach programs should become familiar with the "tools of the trade" described in the marketing process, such as segmenting markets (grouping users by need) and developing marketing plans.

Third, successful marketing efforts are based on involvement and participation of partners in the highway community. Federal and state agencies, local governments, industry, aca-

demia, and international groups must all have a role in the marketing process. All these groups should be included in the identification of needs, design of research, and product development. This cooperation ensures that the right issues are addressed in a timely manner and that opportunities for innovation are recognized and acted upon.

The fourth premise incorporates the first three into a strategic process that ultimately links a technology product or program with targeted user groups and tracks its implementation. This marketing process starts with the identification of needs and extends through the deployment, implementation, and evaluation of products developed to meet those needs.

Marketing Process

"Research without implementation is akin to good strategy without execution" (5). There is no return on investment if a product stays on the shelf. To facilitate implementation, the FHWA marketing process depends on early input from outside groups to guide research and nurture a receptive audience for a product or program as it develops.

The marketing process begins with identification of needs. Problem areas and definition of research programs are discussed with partners in the transportation community to guide this most critical element. In a marketing approach, research is proactive rather than reactive. Customer needs, wants, and perceptions are anticipated and tracked.

The process continues with product development and monitoring. This is not a discrete step, but a continuous flow of feedback from program offices and partners to ensure that research is on track and is addressing the original issue. Field personnel have a "feel" for how a material can perform (10). The goal at this stage is to quantify that feel and feed it back into the product development. The National Society of Professional Engineers developed a similar process for evaluating technology (11) that calls for incremental evaluation and redefinition of the problem as required.

Product analysis is an extension of product development, assessing the need for further testing and refinement, making modifications recommended by potential users to enhance implementation. Market analysis is also an ongoing part of the process relating product development to evolving market needs. It defines levels of use and obstacles to overcome in getting a technology on the market and identifies opportunities to enhance acceptance.

These steps can be presented graphically on a technology life cycle, which relates product development to stages of the marketing process (12) (see Figure 1). The process is envisioned as a flow of information and positioning rather than discrete steps.

The FHWA life cycle associates with steps in the marketing process. Guardrail development, for example, is at a mature stage of its life cycle. Numerous styles of guardrails are now available. Within the marketing process, ongoing product and market analysis determine the need for cost-effective guardrail improvements. For affordability, new features adapt standard guardrail components. Ongoing needs assessment results in engineering modifications for improved safety. Mar-

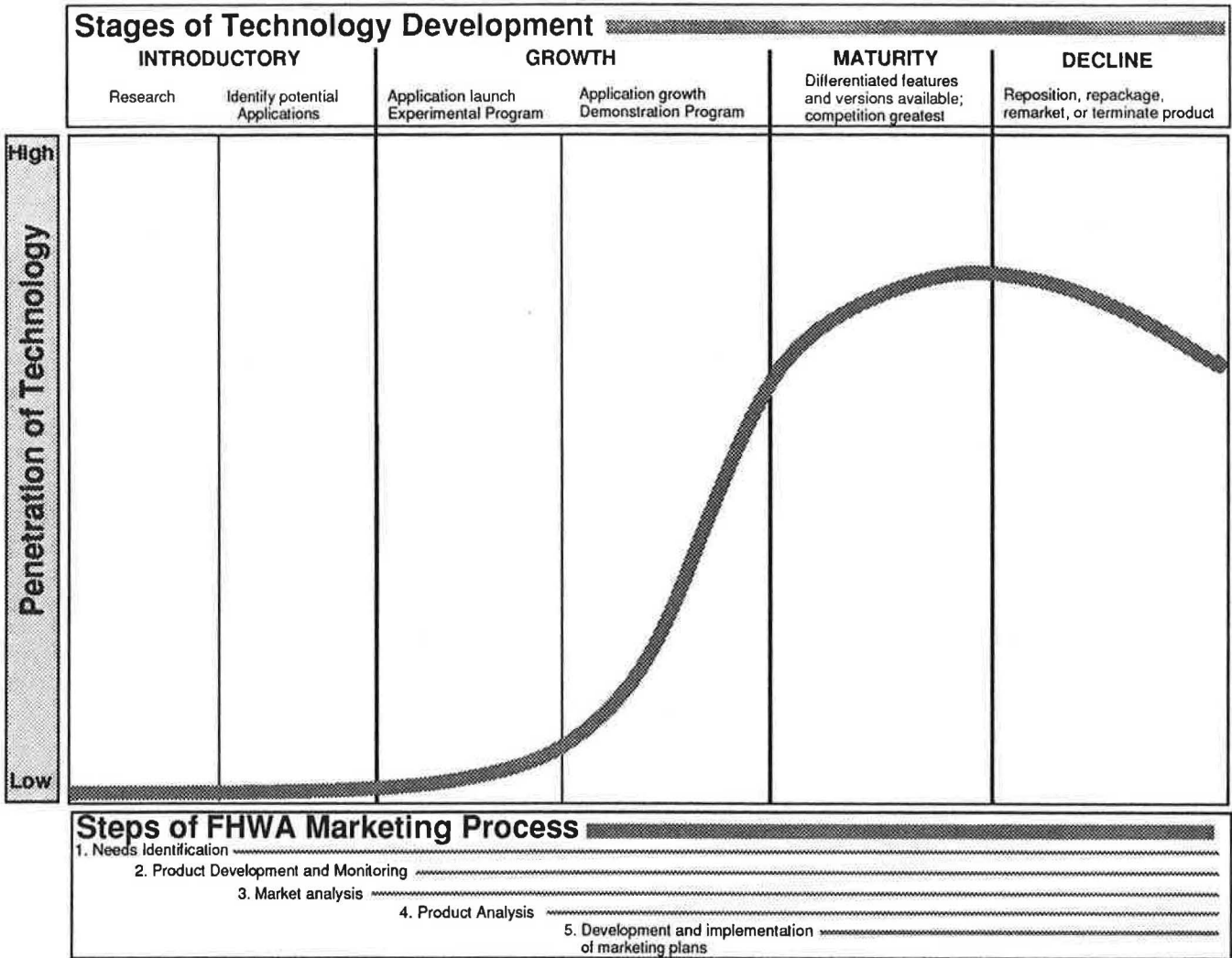


FIGURE 1 Technology life cycle.

keting activities include targeting appropriate levels of users to communicate benefits and information about improved guardrail features.

A marketing plan documents this process of product development and market analysis. The written plan serves to relate the strategic fit of agency goals, resources, and market conditions to developing products and programs. It defines, for a specific planning period, how to allocate resources to a program and how to evaluate performance and effectiveness (13, p. 90). Although they may be perceived of as "more paperwork," plans serve an important function in the application of technology.

A formal plan links research with program facilitators and the ultimate user. It coordinates decision making, sets a timetable for program activities, and establishes a "critical path" so necessary steps are not missed. The primary function of a plan is to improve communication among top management, program offices and other players in the program. It systematically presents analysis, assumptions, expected developments, strategy alternatives, and resource needs.

This level of planning enables FHWA to focus on its goals and objectives and keep its activities within the scope of the marketing plan.

The Office of Technology Applications (OTA) works with the program offices to generate marketing plans for high-priority products and programs. OTA was established in the fall of 1990 to consolidate and strengthen the outreach activities of demonstration projects, experimental projects, the Rural Technical Assistance Program, and technology transfer efforts of the former Office of Implementation. OTA has three divisions—Technology Management, Engineering Applications, and Safety and System Applications.

OTA provides a coordination function within FHWA for funding and managing technology. The office also provides technology transfer expertise in key technical areas through technology assessment and applications activities. Responsibilities of OTA include

- Identifying and assessing technology requirements in the highway community;

- Assessing new products identified through research and other sources;
- In conjunction with program offices, developing and implementing marketing plans for new technology and programs;
- Evaluating the effectiveness of the technology transfer process; and
- Coordinating and planning a national and international marketing program to facilitate adoption of technology products from the Strategic Highway Research Program.

OTA developed formal training in marketing for FHWA technology transfer personnel at headquarters and regional and division offices. In coordination with the National Highway Institute (NHI), this training under modification for continued presentation to technology transfer counterparts in state and local highway agencies and personnel at state university-based technology transfer centers.

This combination of technical expertise and marketing skills at FHWA enhances agency credibility and streamlines program evaluation. Developing marketing skills at every level of technology transfer ultimately speeds technology to the user.

Application of these marketing skills helps organize complex programs such as incident management. Incident management involves coordinating and mobilizing a response team of police, fire, and medical vehicles, and tow trucks, among others, to clear vehicle collisions and other blockages of traffic in a timely manner. The program requires cooperation and teamwork among diverse groups with firmly established roles in traffic operations. An effective program of incident management addresses the need to redefine these traditional roles.

An incident management marketing program can provide a structure for sharing resources with states and local governments. Demonstration projects, reports, and technical assistance can be scheduled in the action plan, with FHWA program offices assigned responsibility for delivery of associated activities. The activities and information packages described in the program plan can be used to create individual marketing plans tailored to the needs of particular communities. Established incident management programs vary widely in nature, depending on the jurisdictional constraints and cooperative opportunities particular to an area.

FHWA addresses the needs of its constituency by working with its partners to develop and prioritize useful products and innovative technology for the highway community. Sometimes the innovation is just a new way of doing business, involving minor changes in operating procedures, or providing a video for instructional purposes rather than a report. A strong marketing orientation in the field attunes transfer agents to the right communication strategies for getting a technology understood, accepted, and in use. The Rural Technical Assistance Program established a decentralized network of technology transfer centers for this purpose. The centers translate technology into useful formats for the local highway organizations and then pull technology from all sources to solve specific problems.

CONCLUSION

Incorporating innovation into the traditional structure of technology transfer required both a philosophical and physical restructure of FHWA. Adoption of a marketing philosophy acknowledges a change from the traditional inward, product focus to a broad, multifaceted consumer focus. Whereas our original technology transfer program focused on the state as the ultimate target of activities, product and program development now includes a wide base of concerns, from those of the driving public at the local level to interests of the international community at large.

The goal of marketing in this environment is to assist the surface transportation community in seeking innovative solutions to transportation problems through focused research and to ensure that these solutions get put into practical application. All decisions toward this goal should be made in reference to needs of the highway community. FHWA has committed resources to developing a strong marketing orientation among its personnel in the program offices and the field. It has reorganized its technology transfer function to provide a marketing management resource at the headquarters level. Although these internal developments are significant, the successful application of innovative technology ultimately depends on the involvement and support of partners in the highway community who help shape the highway program throughout the marketing process.

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