

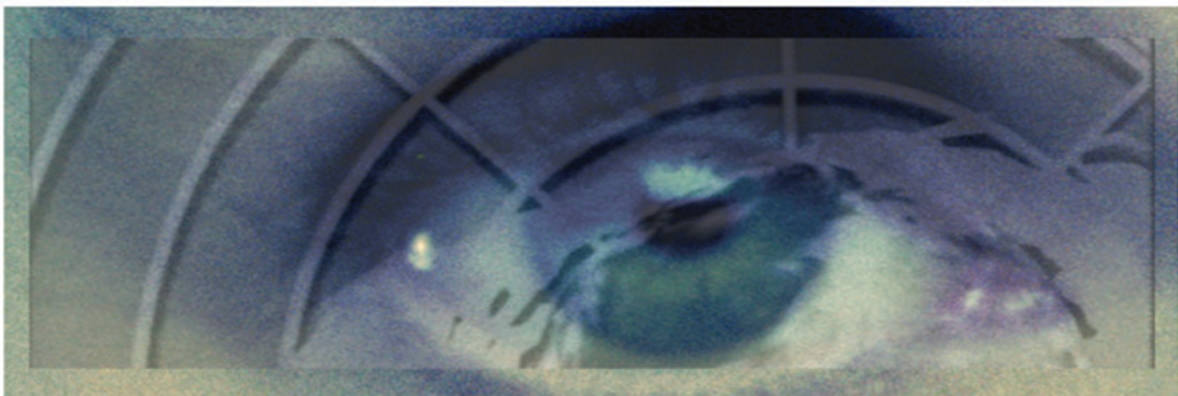


# **Government Policy** and **Program Impacts**



## **on Technology Development, Transfer and Commercialization** **International Perspectives**

Kimball P. Marshall, PhD  
William S. Piper, DBA  
Walter W. Wymer, Jr., DBA  
• EDITORS



*Kimball P. Marshall  
William S. Piper  
Walter W. Wymer, Jr.  
Editors*

## **Government Policy and Program Impacts on Technology Development, Transfer and Commercialization: International Perspectives**

*Government Policy and Program Impacts on Technology Development, Transfer and Commercialization: International Perspectives* has been co-published simultaneously as *Journal of Nonprofit & Public Sector Marketing*, Volume 13, Numbers 1/2 2005.

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to John V. Gully,  
a pioneer in technology marketing.





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## ABOUT THE EDITORS

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# Introduction

It is with pride that we present to you this special volume devoted to the topic of government program and policy impacts on technology development, transfer and commercialization. As evidenced by the papers herein, this field encompasses a wide range of macromarketing issues. Accordingly, the articles presented here are diverse, addressing government sponsorship of technology research, impacts of government regulation on technology marketing, economic development, effects of government policies on business practices, implications of government infrastructure development programs on technology diffusion, protection of intellectual property, and societal marketing and ethical issues of dominant social paradigms and distributive justice in cross-national and cross-cultural perspective. Even with so broad a range of topics represented, we can only hope to have provided a sampler of this important macromarketing field. We do, however, hope that the articles we have selected (all of which have survived a rigorous, triple-blind, peer review process) will stimulate further consideration of the implications of government policies for technology development, transfer and commercialization. Hopefully, the perspectives contained here will lead to further research to guide government policymakers and business leaders in efforts to provide fertile environments for innovations that will improve the quality of life of all peoples.

We, the editors of this special edition, express our appreciation to our colleagues who served as reviewers for this special edition. The reviewers often

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provided extensive comments and provocative observations that enhanced the papers included here. We also express our gratitude to Loyola University New Orleans, Alcorn State University and Christopher Newport University for the support that made this special issue possible.

*Kimball P. Marshall*  
*William S. Piper*  
*Walter W. Wymer, Jr.*

# An Overview of Potential Government Impacts on Technology Transfer and Commercialization

Kimball P. Marshall

**SUMMARY.** Government technology transfer is movement of technology across political boundaries, across social sectors, or from one society to another. Technology commercialization involves applying technology in usable products for economic gain. In “free-market” societies one thinks of technology as developed by the private sector, but governments influence development, transfer and commercialization via sponsorship of, and direct involvement in, research activities, and via programs that affect market demand and transfers across political and social boundaries. This paper seeks to stimulate research into the macromarketing implications of government technology programs by developing taxonomies of objectives and actions and by reviewing these types to suggest macromarketing implications and empirical research needs. *[Article copies available for a fee from The Haworth Document Delivery Service: 1-800-HAWORTH.*

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**KEYWORDS.** Government technology programs, regulation, technology transfer, technology commercialization, macromarketing

*We, the People of the United States, in order to form a more perfect union, establish justice, insure domestic tranquility, provide for the common defense, promote the general welfare, and secure the blessings of liberty to ourselves and our posterity, do ordain and establish this Constitution for the United States of America. (Preamble to the Constitution of the United States of America)*

## INTRODUCTION

For centuries, governments have engaged in the development of new technologies for reasons ranging from desire for military superiority to concerns for public health and the quality of life of citizens. Governments directly employ scientists and engineers to develop inventions, improve upon new technologies or carry out “basic” research. Governments also fund private sector enterprises via grants or contracts to carry out similar activities. Often the resulting technological advances have private sector commercial potential and the potential to enhance the quality of life of all members of the society.

In some cases government-funded technologies have had dramatic commercial effects as private sector industrial and consumer products (Port 2002a,b; Franza and Widmann 1996, Mraz 1996, Piper and Naghshpur 1996, Zeller 1996, *Aviation Week and Space Technology* 1995, 1994, Radosevich 1995, Scott 1995, Kandebo 1994, Proctor 1994, United States Government Accounting Office 1992). Recent examples include radar, microwave ovens, modern cell phone systems, and the Internet. Other examples include the development of new materials for commercial aircraft and personal vehicles, and medical instrumentation. Therefore, it is not surprising that governments have recognized and sought to exploit the military, economic, and political potentials of technology development, transfer and commercialization. In the United States, the result has been the development of myriad programs at the national and local levels.

Government technology development transfer and commercialization programs may be of special interest to academicians and marketing practitioners

for at least two reasons. From a “macromarketing” (Fisk 2001, 1999, 1982) perspective, government technology programs and policies affect influence commercial opportunities by influencing which technologies are emphasized, by stimulating markets for products through government purchases, and by constraining or facilitating intellectual property rights. Unfortunately, marketers have not systematically addressed government technology programs, their design or their marketplace impact.

Macromarketing studies of government technology programs might offer two benefits. First, studies could provide new insight into marketplace impacts of government involvement in technology. Second, macromarketing insights might lead to more effective business partner recruitment, as required by many government programs (Piper and Marshall 2000). Program success often requires that private firms act as business partners with government agencies. However, government programs often struggle to recruit effective commercialization partners despite widespread promotion efforts (Small Business Innovation Research Center 1997; Roberts and Malaone 1996; Unisphere 1996; Zeller 1996). A macromarketing perspective might yield more effective policies and procedures for attracting committed commercialization partners.

This paper develops an exploratory framework for classifying government technology objectives and actions. Macromarketing implications of government involvement in technology are considered throughout the discussion, and research questions are identified that, if addressed, could provide policy guidance. No assumption is made that government technology programs are “good” or “bad,” or efficient or inefficient vehicles for bringing the benefits of technology to the people of the world. The diverse literature on the benefits of free markets for innovation (Smith 1981, Novak 1997) is recognized. The present goal is only taxonomy. An easily understood, parsimonious framework that could be applied cross-nationally is sought. As the effort is exploratory, exhaustive, mutually exclusive categories are not required. Some readers may wish to break the categories developed here into sub-types, to add categories, or to collapse categories together. Such criticisms are welcomed as important efforts in developing a paradigm to guide research into policies to bring the benefits of technologies to all peoples and societies.

### ***A MACROMARKETING PERSPECTIVE***

“Macromarketing” will refer herein to the study and development of social structures, institutions and processes that influence exchange among businesses and consumers in a society (Fisk 2001, 1982). We offer this definition

as consistent with Hunt's definition of macromarketing as cited by Meade and Nason (1991) ". . . the study of (1) marketing systems, (2) the impact and consequence of marketing systems on society, and (3) the impact and consequences of society on marketing systems" (Hunt 1977, p. 6). Economic systems in general, and marketing exchange systems in particular, derive from the institutional structures and cultures of social systems, within nations and cross-nationally. Institutional structures include government policies and programs and are of concern from a macromarketing perspective in that actions of governments influence opportunities and conditions under which exchange occurs. Macromarketing elements develop from both government actions and private-sector initiatives, but, at some point, government involvement is to be expected in economic transactions, at least in the form of regulation of existing institutions and processes, or the stimulation of new institutions or processes. For example, early real estate transactions might have operated with a "handshake" agreement, but in short order government involvement came about to validate deeds, tax property, and restrict land usage. As transactions became more complex, involving additional parties, mortgages, regulated interest rates, and contract enforcement mechanisms guaranteed by courts, social structures and processes developed to create and enforce regulations and procedures. These institutions are infrastructure elements that influence market transactions. Where some people see government processes, taxation and regulation as encroachments on liberty and free markets, others see as benefits that contracts are enforceable in court and land values are protected. Presumably, these benefits allow "free" markets to operate with greater trust, stability and efficiency (Smith 1981). But, this is itself an empirical question to be asked of any government action. Even well-intended government actions might have unintended, undesirable consequences. Government abuses of regulatory power can occur, unjustifiable taxes may be imposed, unfair restrictions might be placed on property, and government buying power international trade regulations might distort free market efficiencies and diminish competition and competitive innovation. In international perspective, government trade treaties and policies might open doors to free trade, or create market imbalances and inefficiencies (Tobin 1991).

Government programs and policies manifest in law, regulation and sponsorship activities (West Publishing Company 1991) are important macromarketing infrastructure components that influence technology markets. These components influence which technologies will be developed, opportunities to stimulate and fill market demand for a new technology, the social impacts of new technologies, and opportunities for and constraints upon marketplace exchanges involving new technologies at the business and consumer levels. It is important for marketing academicians and government pol-

icy makers to have a paradigm to guide planning and assessment of programs and policies that influence technology development, transfer, and commercialization. A step toward such a paradigm may begin with consideration of two dimensions of government programs, program objectives and program activities. As a starting point, we define below typologies for each dimension and consider possible market impacts.

### ***OBJECTIVES OF GOVERNMENT TECHNOLOGY PROGRAMS***

While a variety of government objectives for involvement in technology programs may be suggested, in the interest of parsimony and a systematic approach we propose nine broad categories of objectives of government involvement in technology programs. These are listed in [Table 1](#). Four categories stand alone: military defense, public safety, improvements in quality of life, and national diplomacy. Five are sub-categories of economic development: economic protectionism, jobs creation, new business formation, export stimulus, and foreign business investment.

#### ***Military Defense***

Although the proper roles of government are debated, there is consensus for military defense and public safety as legitimate government functions (Smith 1981). All societies must have the ability to protect their geographical boundaries from encroachment by outsiders, secessionist efforts, and in some cases, expansionist efforts by non-government groups. Military defense serves as one important aspect of boundary maintenance. In the modern world, boundary maintenance has expanded to encompass “national security,” and military

TABLE 1. Objectives of Government Technology Programs

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|                             |
|-----------------------------|
| Military Defense            |
| Public Safety               |
| Quality of Life             |
| Economic Development        |
| Economic Protectionism      |
| Jobs Creation               |
| New Business Formation      |
| Export Stimulation          |
| Attraction of Foreign Firms |
| International Diplomacy     |

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systems are often used outside of physical borders to protect what are deemed by government leaders to be the “strategic interests” of the country. Ostensibly, violation of a country’s strategic interests if unchecked would eventually endanger the recognized physical boundaries of a nation.

Today, with nuclear weapons, intercontinental missiles, instantaneous worldwide communications, and a global economy of multi-national mutual dependence, almost all developed and developing countries are involved in military technology. Military technology programs are carried out in government laboratories and by external organizations under contract and grants. Beyond debates over the morality of war and “banned” weapons, little debate exists regarding the legitimacy of government involvement in technology development for military defense. Debate does occur over the extent to which governments should develop technology in-house or use outside firms, whether commercial market technologies should be sought first, ownership of developed technologies, under what arrangements military technologies should be transferred to private firms for commercialization (Wessner 2003). Such debates involve two fundamental macromarketing questions. First, are there military risks associated with private sector involvement in the development or commercialization of the technologies in question? Second, does government involvement in military technology development enhance or impede free-market processes in regard to technology development, transfer and commercialization?

The first question would seem to be easy to resolve. If national security is at risk, the technology should not be transferred. Still, determinations are not easily made, and government agencies may take cautious positions constraining transfer of technologies. The second question is more difficult. Given the size of defense budgets in some developed nations such as the United States, government involvement in technology development might direct interest in emerging technologies in ways that are not marketplace efficient. Where large defense budgets and grants are available, disproportionate resources can be directed to technologies with little commercial benefit outside of future sales to governments. This problem has confronted the Small Business Innovative Research Program (SBIR) sponsored by the Federal government of the United States even though Federal law mandated that government funded technologies meet agency needs and have private sector commercial potential (Federal Laboratory Consortium for Technology Transfer 1991; Wessner 1999). Thus, key macromarketing issues worthy of future research include:

- Does military spending on technology development lead to the inefficient use of social resources for technology development?

- Under what circumstances, if any, do military involvement in technology transfer impede the transfer and commercialization of technologies for non-military applications?
- Can policies and programs be developed that provide for military technology needs while allowing “free-market” forces to optimally prioritize technology development activities in a modern society?
- Do government expenditures for military technology development programs encourage development of the most appropriate technologies for agency needs, are do such programs inefficiently focus research on agency favored approaches?

In varying degree and with minor editing, the same questions might be asked in regard to government expenditures by any agency whether the agency is concerned with military defense, public safety or the enhancement of quality of life of citizens.

### ***Public Safety***

Despite consensus that a key function of government is public safety, debate quickly develops over the meaning of the term and the limits that should be imposed on government involvement (Becker 2002). Public safety includes such diverse areas as police work, security monitoring, guns and explosives safety, transportation safety, and food and drug safety. As with the military, public safety agencies often engage in programs to develop technologies for tools to increase effectiveness and efficiency, but public safety agencies worldwide also address regulations regarding the use of technologies. An example is the ongoing controversies over food irradiation in Japan and in the European Union (Pickett and Suzuki 2000, Emrig 2002).

Budgets of public safety agencies are typically smaller than military budgets, but public safety budgets are substantial and raise similar questions. *To what extent do government technology programs devoted to public safety divert social resources toward agency favored technologies and away from the development of technologies that might be more favored by the commercial marketplace and that might be superior even for agency applications?* Regarding commercialization, it might be expected that public safety agency technologies would have private sector applications and be well received by commercial markets. However, the extent to which technologies developed for a specific agency purpose, even in the area of public safety, are transferable to private sector applications, or to uses by other government agencies, remains an empirical question. Is it realistic to assume that technologies developed for a specific government function would be readily adaptable to

commercial purposes that were not anticipated in the development process (Eldred and McGrath 1997a, b)? As with military programs, an important macromarketing question is whether government sponsorship better directs technology development to meet public and government needs as compared to free market forces directing technology development.

The objective of protecting public safety is also applicable to regulatory activities. Debates regarding product regulation abound (Becker 2002, Pickett and Suzuki 2000). Automobile and food and drug safety, are common examples. Even where technology is developed in the private sector, regulatory mandates may restrict or even mandate product designs. One example is Food and Drug Administration monographs that specify acceptable formulations for over the counter (OTC) medications. These FDA regulations emphasize two concerns, physical safety and product efficacy (CDER 1999). However, as Becker argues (2002), market forces in the private sector and civil tort actions drive companies toward safe products, and market forces themselves lead to the failure of products that do not perform as expected. In Becker's view, product safety is relatively easy to determine, but current FDA efficacy demonstration requirements for drugs not covered by current monographs are so expensive that they may prevent the rapid transfer of new technologies into affordable commercial products. Recent changes in FDA processes have begun to address this issue, but the controversy persists (Carey 2003, Weintraub 2003). Thus, another area for macromarketing research would be the risk of latent dysfunctions of government product regulations in the interest of public safety.

### *Quality of Life*

Quality of life and public safety are closely related, but, as used here, quality of life refers to broad improvements in living conditions that go beyond public safety. Quality of life indicators often include such issues as public health, medical care, adequate housing, and a general sense of well being. While such concerns are "justified" under the "promote the general welfare" clause of the United States Constitution (Cheeseman 1997), debates continue as to whether enhancing quality of life is a legitimate role of government. Still, the many government agencies engage in R&D in search of healthy food products, safer automobiles and highways, safer commercial and personal aircraft, safer guns, fuel-efficient homes and automobiles, medical devices, pollution avoidance and correction technologies, and so forth.

Quality of life technology topics reflect the broad scope of agency mandates. Legislation specifies topics, but agencies also set agendas that might be only broadly indicated in enabling legislation. This raises several macro-



marketing research questions. Do government or market forces more efficiently direct technology development and commercialization to enhance quality of life? Under what circumstances are government technology expenditures to enhance quality of life a necessary aspect of promoting the general welfare and efficient mechanisms for achieving desired benefits? Are there situations in which private sector initiatives are not viable and the social need is so great as to justify government action? What is the risk that government programs might promote one technology in contrast to what would occur in free markets? If quality of life were judged from the perspectives of individuals in society, would commercial markets or government programs more closely reflect those perspectives? The work of Fisk (1998) is an example of the application of macromarketing perspectives to ecological and physical environment quality of life issues by describing and proposing public policies based on “mutual coercion” and “reward and reinforcement” strategies.

### *Economic Development*

Economic development is a major objective of government technology programs. Technology development, transfer and commercialization have been linked by policy makers and researchers to national and firm competitiveness, jobs creation, and the revitalization of economically disadvantaged geographic areas and peoples (Peterson and Sharp 2002, Steensma, Marino and Weaver 2002, Barnholt 1997, Zadoks 1997, Pegels and Thirumurthy 1996, NASA 1996a, b, c, Marshall 1995, Proctor 1994, McKee and Biswas 1993, Mullen 1993, Morbey and Reithner 1990, Brenner and Rushton 1989, Franko 1989, Ayal, Peer and Zif 1987, Goeke 1987, Nason, Nikhilesh and McLeavey 1987, Cundif 1982). However, from a macromarketing perspective, does government involvement risk creating market inefficiencies? Do government technology programs achieve economic development objectives? What latent dysfunctions may result? To provide a framework for considering such questions, [Table 1](#) suggests five broad economic development objectives of government technology programs: economic protectionism, jobs creation, new business formation, export stimulation, and attraction of foreign firms.

### *Economic Protectionism*

As used here, economic protectionism refers to creating trade barriers to buffer domestic firms from non-domestic competitive pressures. Tariffs, import quotas and domestic content requirements are examples of barriers. Critics claim protectionism impinges on free markets by creating artificial conditions that affect costs, prices and supplies in order to limit competition

and favor domestic firms. Proponents argue that protectionist policies level the competitive field vis-à-vis firms that benefit from anti-free market policies of other countries. Arguments favoring government economic protectionism are that such policies defend property rights (as in the case of international product counterfeiting), prevent unfair competition (as in the case of anti-dumping laws), and provide time for a domestic industry to adapt to new technologies and gain sufficient strength to compete or adapt to new conditions. Such policies have been used in Japan (Goto 2000, Yu 2000, Odagri and Goto 1999), India (Kumar and Jain 2003), and the European Union (Peterson and Sharp 2002). A classic example is the United States case of Harley Davidson Motorcycles during the Reagan Administration the early 1980s. Besieged by the success of Japanese motorcycles imported into the United States and threatened with bankruptcy, Harley Davidson obtained government protection in the form of import quotas and tariffs, and domestic origin requirements for police motorcycles purchased with Federal funds, while restructuring product lines and production processes and facilities. Although today Harley Davidson Motorcycles is a highly successful company, the benefits and risks of economic protectionist policies as opposed to free-market processes call for further research.

In India, until recently, non-domestic firms seeking to open facilities were required to establish domestic companies with over fifty-percent Indian ownership. After years of relative economic isolation, China today encourages foreign trade and investment, but requires that this be tied to significant technology transfers. The objective is to assure that access to Chinese markets and labor supplies are tied to the development of technology infrastructure needed if domestic industries are to compete beyond cheap labor (Einhorn et al., 2002). EU policies also include protectionist objectives. To escape substantial tariffs, products sold within EU countries must have fifty-one percent EU produced components or labor. It is clear that protectionism is common public policy throughout the world. From a macro-marketing perspective, empirical research is needed to assess the impact of economic protectionist policies on trade opportunities, and the development of competitive strengths by domestic firms. While protectionist policies might provide time for domestic industries and firms to adapt, there is the risk that firms will instead become dependent on economic isolation and captive domestic consumers.

### *Jobs Creation*

Jobs creation is a key economic objective of government technology policies and programs. Theoretically, by creating opportunities for new and improved products, government programs stimulate market demand for new

products and enhance competitive advantage of domestic firms and products, and thus stimulating job growth. Consider the following statement from the 1998 Technology Transfer Report of NASA's Goddard Space Flight Center.

The products and processes developed by transferring technology to U. S. industry increase the nation's competitiveness, create jobs, improve the balance of trade, and enrich the lives of its citizens. (NASA 1999, p. 1)

Despite such statements, little evidence exists to demonstrate real net increases in job opportunities from transferred technologies in developed countries. Logically, net increases in jobs would result from new technologies only if highly demanded new products are created, and if these new products do not lead to the obsolescence and loss of old jobs, or lead to new jobs that more than replace eliminated old jobs. One must distinguish between new job creation and enhancement of current jobs. The author recalls interviews carried out for a NASA satellite imagery program in which executives and workers in traditional aerial photography firms were interviewed regarding the potential benefits of the new technology. An often-mentioned concern was that the government was "competing" with current firms and that this would lead to the loss of business and jobs. Therefore, empirical research is needed to demonstrate the true effect of government technology programs on labor markets overall.

#### *New Business Development*

New business development, stimulating formation of new competitive firms, is a common goal of government technology programs that also requires empirical study. New technologies might create business opportunities leading to new business start-ups. This was the case with the Internet, aeronautics, and transportation, microwaves, and biotechnologies (Weintraub 2003). But new business start-ups often fail in risky, new technology situations. Government technology programs might cause new R&D and consulting businesses to emerge to service government grants and contracts, but there is a lack of evidence (Scott 1994, United States General Accounting Office 1992) that government technology programs generate new businesses in great number, or that such businesses survive over many years as going concerns independent of government funding. More likely, but also speculative, the market potential of new technologies may be exploited by larger existing firms that integrate government-sponsored technologies into their own R&D agendas and product lines. Therefore, research needed to assess the new potential for new business start-ups, and the macromarketing environments and govern-

ment policies under which viable firms are most likely to develop. If government programs encourage development of new firms in technology areas that are not market driven, such firms are likely to fail without continuing subsidies.

#### *Export Stimulation*

*Export stimulation* refers to government activities to increase foreign demand for domestic products. When domestic firms in one nation have technology capabilities that provide superior products over firms of other nations, government efforts (through trade missions, databases to identify foreign business opportunities, and international agreements to reduce protectionist trade restrictions) would benefit domestic firms (Magnusson 2003) and foreign trade partners. However, export stimulation might also take other forms, such as tying foreign aid programs to purchases of products produced by the aid-providing country. Such activities impinge on free market activities and create artificial demand for the favored firms' products. Moreover, if free market forces are not allowed to select the most competitive opportunities for the countries to which aid is targeted, the expenditures of aid monies might inefficient and ineffective in achieving humanitarian or diplomatic goals. This raises empirical questions regarding commercial effects of programs to stimulate technology exports. For future research, it might be hypothesized that the greatest benefits occur when export stimulation programs seek to open free markets, and that market inefficiencies result where export stimulation programs impinge on free market competition by providing favored status to certain firms.

#### *Foreign Business Investment*

Foreign business investment, also referred to as foreign direct investment, or FDI, is a common goal of government technology programs. In the United States, Federal, state and local governments actively seek to recruit firms from outside their geographic territories to locate facilities in their own regions, as do governments in many other nations. China (Zang and Taylor 2001), India (Sikka 1996), and Mexico (Smith 2003), for example, have active programs to attract foreign business investment in the form of production facilities and other forms of technology transfers. The intention is to create jobs and stimulate wealth enhancing economic activities. By recruiting technology firms, government agencies hope to generate high paying jobs that will benefit tax revenues and the quality of life of peoples in the targeted region. Examples of FDI success stories in the United States include efforts to recruit vehicle

factories in Alabama (Mercedes), Mississippi (Nissan) and South Carolina (BMW).

One danger of efforts to recruit outside firms is that inducements to encourage firms to locate in a nation or region often focus on tax exemptions and physical infrastructure, without addressing the broader needs of targeted industries. Geographic areas that fail to develop advantages matched to needs of targeted industries, advantages beyond low taxes, labor and construction costs (McKee and Biswas 1993), may find that firms leave in search of infrastructure benefits such as educational and research systems and collaborating businesses that are critical to technology activities (Geisler 2003, Jones and Teegen 2003, Yu 2000, Marshall 1995, McKee and Biswas 1993). To develop such advantages, governments, particularly at the local and state level in the United States, have adopted the “industry cluster” model (see for example recent Louisiana economic development through technology plans—Louisiana Economic Development 2003, Louisiana Economic Development Council 2003, Louisiana Business Inc. 2002). The cluster model recognizes the interdependence and common needs of firms in an industry, and develops programs that meet these needs in areas of physical infrastructure, education and human capital development, cultural adaptations, and business collaboration (Geisler 2003, Marino et al. 2002, Steensma et al. 2000, Tornatzky et al. 1996, Marshall 1995, Nason, Dholakia and McLeavey 1987, Goeke 1987). Cluster programs seek to attract technology firms, to stimulate new business formations, and to create better paying, more secure jobs and a better quality of life for people in the region. Austin, Texas is an example of a geographic area that has successfully emphasized technology clusters and education and business networks in economic development marketing (Engelking 1992).

### ***International Diplomacy***

The last objective for Government Technology Programs in [Table 1](#) is “international diplomacy.” To develop international strategic alliances or to encourage other countries to adopt desired policies, governments might encourage (or discourage) technology transfers through approving (or disapproving) authorizations for trade, joint research programs, or sharing military technologies. Diplomatic objectives may be to attain desired resources, to influence internal political processes, strengthen a friendly government, or gain or enhance a military alliance (Magnusson 2003). Through technology transfers the target country gains knowledge to create or enhance domestic industries. However, while both countries can benefit, there seldom are guarantees that the technologies transferred will be used only as intended, and the transferring country or its government might feel political repercussions. The

1990s controversy regarding missile technology transferred from the United States to China is an example of a program in which diplomatic objectives created a political backlash. Although the United States government denied a problem, political opponents expressed fears that technologies transferred for civilian economic programs had military applications that could be threatening to the United States (Pomper 1998). Diplomatic policies that affect trade represent a dimension of macromarketing infrastructure and are a worthy, but underdeveloped, area of macromarketing research.

### ***GOVERNMENT TECHNOLOGY PROGRAMS BY ACTIVITY TYPES***

Throughout the previous discussion of government technology program objectives examples have been cited of technology related actions taken by governments. In the following sections, technology related actions are presented in a more systematic manner. A typology is presented of actions that are often used in government technology programs. As before, the objective is not to create an exhaustive or mutually exclusive taxonomy. The intention is only to begin the process of organizing a complex field so as to facilitate empirical research. To this end, [Table 2](#) cites six major types of actions that are often used in government technology programs. Each of these is then classified into sub-categories and briefly discussed.

#### ***Intellectual Property Protection Laws and Enforcement***

The main types of actions are typically used to protect intellectual property: patents, copyrights, trademarks, and service marks. In all three cases, only persons or organizations that have received permission from the holder of the protection may use the resources, and then only in the manner for which permission was given. Patent rights may take several forms, such as a product patent, a process patent or a design patent, and may be granted as a general patent or may be limited to a specific application. In the United States the developer of a technology must formally apply for a patent and demonstrate its utility before protection is granted. Copyright protection may extend to written materials, computer software, and works of art. Copyright protection is granted when the work is first developed even if the developer does not formally register the material. However, without formal registration, developers may find it difficult to demonstrate primacy. Trademarks are spoken and graphically styled words, phrases or images that are used to uniquely identify a product or firm. Trademarks do not have to be registered, although service marks (trademarks associated with service businesses) do have to be regis-

TABLE 2. Types of Government Technology Programs Activity Area

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|   |
|---|
| Intellectual Property Protection                        |
| Patents   |
| Trademarks  |
| Copyrights  |
| Direct and Indirect Technology Development              |
| Government Labs   |
| College and University Grants and Contracts             |
| Grants and Contracts to Private Sector Firms            |
| Direct Commercial Technology Transfers                  |
| Licensing   |
| Exclusive   |
| Non-Exclusive   |
| Assignment of Patents and Copyrights                    |
| Infrastructure Development                              |
| Physical Infrastructure Incentives                      |
| Social Infrastructure Initiatives                       |
| Education Program Development                           |
| Grants  |
| Contracts   |
| Set Aside Programs                                      |
| Import Quotas   |
| Foreign Content Restrictions                            |
| Import Tariffs  |
| Duty Free Zones   |
| Market Stimulation Activities                           |
| Government Purchasing Contracts                         |
| Government Trade Missions                               |
| Free-Trade Agreements                                   |
| Regulatory Mandates for Technology and Design Standards |
| Public Education Social Marketing Programs              |
| Demarketing Programs                                    |
| Banned Products   |
| Domestic Taxes  |
| Regulatory Restrictions                                 |
| Export Restrictions                                     |
| Public Education Social Demarketing Programs            |

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