Small Business Innovation Research Program in the United States: A Political Review and Implications for East Asian Countries†

Youngbok Ryu*

Abstract

The study examines the U.S. Small Business Innovation Research (SBIR) program, with a focus on the recent Reauthorization, and compares, in the political context, the U.S. and East Asian countries—Japan, Korea and Taiwan—that adopted the U.S. SBIR program. For the systematic analysis and cross-country comparison, the study employs Kingdon (2003)'s framework—his political theory and Garbage Can Model—to identify political participants and processes underlying the SBIR Reauthorization and to analyze the differences in problem, policy, and politics streams between the U.S. and East Asian countries. For the cross-country comparison, specifically, the study uses various data sources such as OECD, Global Entrepreneurship Monitor, Hofstede's Cultural Dimensions, and World Value Survey. Based on the analysis outcomes, implications of U.S. practices on East Asian countries are extracted as follows. East Asian countries tend to: Have higher entrepreneurial aspiration while lower entrepreneurial activity and attitude than the U.S.; bear higher long term orientation and uncertainty avoidance while lower individualism than the U.S.; and have greater expectations of technology development and higher confidence in political parties while participating less in political action than the U.S. Drawing on the differences, the following policy recommendations are suggested. East Asian countries should: Improve entrepreneurs' access to resources (in particular, financial resource) in order to link their high entrepreneurial aspiration to actual entrepreneurial activities; cultivate failure-tolerating culture and risk-taking entrepreneurs, for instance, by providing a second chance to SBIR-participating businesses that failed to materialize their innovative ideas; and leverage their high expectations of new technology in order to take bold actions regarding their SBIR programs, and update the programs by drawing out constructive dialogues between SBIR stakeholders.

Keywords
Small Business Innovation Research (SBIR), East Asia, United States, Garbage Can Model, olitics

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* Ph.D. Candidate, Policy Analysis Program, Pardee RAND Graduate School, Santa Monica, California, USA, yryu@prgs.edu

1. INTRODUCTION

Despite the rise of East Asian countries, the United States (U.S.) still maintains its leadership in many aspects. In the third quarter of 2014, for instance, the U.S. real GDP increased at the largest rate—5 percent—in 11 years,[1] which surpassed everyone's expectations. Numerous American companies, including Apple and Google, continue to develop innovative technologies, to tap new markets and to prosper. Based on U.S. economic (and technological) fundamentals, President Obama received his biggest approval rating—50 percent—since May 2013 (Blake, January 19, 2015), contributing to political stability.

In contrast to the recent successful performance of the U.S., East Asian countries[2] that were once called Asian Tigers (or Dragons) or the East Asian Miracle are stagnating. Despite Abenomics—the economic stimulus policies advocated by the Prime Minister Shinzo Abe—for instance, Japan is struggling to escape the effects of a long-term recession and earthquake disasters (particularly, the economic and political shocks resulting from the earthquake and tsunami damage to the Fukushima nuclear reactor site) at a time of political tension with China. South Korea, often referred to a chaebol (a form of business conglomerate) economy, is also losing its economic and technological fundamentals and taking potential risks with North Korea. Taiwan is showing relatively better performance and recovery from the global financial crisis, but it relies heavily on international trade (specifically with China) that would be affected by slowdown of China's economy. The relationship also exposes Taiwan to the political challenges of the relationship with mainland China.

Faced by such economic (and technological) difficulties in unstable political settings, what can East Asian countries do? More specifically, given that all East Asian countries have strong manufacturing bases—specifically related to information and communications technology (ICT)—and heavy dependence on international trade, what kind of technology and innovation policy might help them recover from current stagnation and make another leap? To answer these questions, it is useful to look into what contributed to the current U.S. success.

What invigorates the U.S. economy is the new technology and innovation ecosystem the U.S. is building. Similar to the current situation of East Asian countries, the U.S. had to wrestle with issues of decreasing competitiveness in 1970-80s. But, the U.S. managed to transform challenges to opportunities through successful government policies, specifically ones related to technological innovation, e. g., the America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science Act (America COMPETES Act). While some government policies such as R&D policy (e.g., R&D tax credits) and intellectual property policy (e.g., pro-patent policy) were helpful to regain U.S. competitiveness, policies targeting a public-private partnership (PPP)

[1] U.S. Department of Commerce, Bureau of Economic Analysis. Available at http://www.bea.gov/newsreleases/glance.htm

[2] The study focused on three countries that adopted the U.S. Small Business Innovation Research (SBIR) Program—Japan, South Korea, and Taiwan—instead of including all East Asian countries.

also played a pivotal role. For instance, policies on technology transfer and commercialization from public sector to private sector, including the Bayh-Dole Act (Patent and Trademark Law Amendments Act) and the Stevenson-Wydler Technology Innovation Act, accelerated the capitalization of publicly-funded research outcomes. Policies on PPP of institutions such as the Defense Advanced Research Projects Agency (DARPA) and Advanced Research Project Agency – Energy (ARPA-E) spurred the development of game-changing technologies through collaborations between government agencies and academia/industry (ITIF, February 3, 2012).

Of various PPP experiments on national innovation systems, one of the promising policies was the Small Business Innovation Research (SBIR) Program. The program is unique in that it put emphasis on the innovation of small business or technology-based entrepreneurship relative to big business, and on the technology transition—i.e., technology flow from the private sector to the public sector—relative to technology transfer—i.e., technology flow from the public sector to the private sector. In addition to its intrinsic characteristics, the SBIR program is extrinsically unique in that it continues to be reauthorized and expanded with bipartisan political support, in contrast to many other R&D programs that were the target of political criticism and consequently did not survive. Such a favorable external environment for the SBIR program enabled the U.S. government to keep providing small business with financial and technological (and even managerial) assistance.

Considering the small business account in the U.S. economy, the SBIR program helped small businesses be created, survive and grow, and enabled them to create a substantial number of jobs and to offer disposable income that leads to domestic demand. This upward consumption power likely made a strong contribution to recent U.S. economic success.

In this context, the study summarized the U.S. SBIR program, analyzed its recent Reauthorization, and compared the U.S. with East Asian Countries using an analytic framework—Kingdon (2003)'s political theory and Garbage Can Model. Further, the study sought to extract implications that U.S. practices and the differences between the U.S. and East Asia have for East Asian countries' SBIR program formulation and implementation. To that end, the study sought to answer the following research questions:

1) What is the history of the U.S. SBIR program and what are the latest additions to the U.S. SBIR Reauthorization Act?
2) Who are participants and what processes underlie in the arena of the U.S. SBIR program?
3) What enables the reauthorization of the U.S. SBIR program as a policy window?
4) What implications does the U.S. SBIR program have for East Asian countries given that there are many different aspects in political atmosphere between two?

2. BACKGROUND

The definition of small business[3] varies across countries and industries (Harvie & Lee, 2002). While most countries use the number of employees to distinguish small business from big business, others consider different criteria such as capital, assets, sales, and production capacity. Even, when using the number of employees, each country sets different numbers as a threshold. For instance, while the U.S. recognizes small business when it has less than 500 employees, East Asian countries use 200 or 300 employees as a cutoff point and take capital, assets, and sales into account as reference points. In addition, these criteria are applied differently to manufacturing and service industries in both the U.S. and East Asian countries.

Though the terms small businesses and SMEs (small and medium-sized enterprises) are nuanced in different regions, their contribution to economy (particularly to employment) is substantial everywhere. Small businesses account for about half of national economies while responsible for about two third of national employment (see TABLE 1). Due to different characteristics such as industry structure and government policy, there are differences in the economic contribution of small business across countries. However, there is consensus on the important role of small business, with a special focus on the way small business creates jobs and alleviates poverty through technological innovation.

TABLE 1. Small Business Contribution to National Economy in the U.S. and East Asian Countries

Percent of SME contribution	U.S.	East Asian Countries			
		Average[a]	Japan	Korea	Taiwan
To economy	>50% (GDP, 2010)	45%	51% (GDP, 2009)	54% (GDP, 2010)	30% (Total Annual Sales, 2011)
To employment	56% (2009)	77%	66% (2009)	87% (2011)	78% (2011)
To export value	15-25% (2009)	20-30%	15-25% (2012)	35-50% (2011)	15-25% (2011)

Note: Averagea = average of Japan, Korea, and Taiwan
Source: APEC SMEs Profile (APEC, 2013), compiled by author

In addition to their effects on national economies, small businesses contribute to national competitiveness by promoting innovation, creating fresh ideas, and commercializing new products. This is equally true in the U.S. and East Asian Countries, as it is elsewhere. In particular, small businesses provide governments with solutions to technical problems, through the SBIR program. Through

[3] In the study, the scope of small business was expanded to include small and medium-sized enterprise (SME).

this program, small businesses identify technical feasibility, assess technological impact, conduct R&D, and commercialize R&D outcomes. By hedging the financial risk associated with R&D, SBIR funding encourages small businesses to tackle high-risk R&D initiatives; it also supports the commercialization of potential discoveries, and allows small businesses to later harvest the returns.

With President Obama's recent emphasis on the commercialization of federally funded R&D (The White House, 2011) and a Congressional request to build a database of commercialized outcomes for the purpose of SBIR program evaluation (GAO, 2011), interest in how the program leads to technology transition is increasing. As a result, the U.S. Department of Defense (US-DOD), which has the largest SBIR budget among federal governments, requires small businesses to submit commercialization documents with SBIR applications. It also implements the Commercialization Readiness Program (CRP) (Flake, 2012). The U.S. National Institutes of Health (US-NIH), on the other hand, helps small businesses identify niche markets and develop market plans through a technical assistance program. The U.S. National Science Foundation (US-NSF) seeks to reflect industry needs in its SBIR topics to facilitate technology commercialization.

Although these commercialization efforts apply globally, each country, in particular East Asian countries including Korea, Japan, and Taiwan,[4] operates the SBIR program independently and seeks to manage the program in accordance with its own political atmospheres—e.g., different small businesses and innovation policy settings. For instance, Taiwan's SBIR program is managed by the Ministry of Economic Affairs and its first and second phases are independent, while the U.S. program is administered by the Small Business Administration (US-SBA) and its phases are interconnected. Unlike other countries, Korea allows public corporations as well as government agencies to participate in KOSBIR (Korea SBIR) program[5] .

Nonetheless, there is consensus on the desire to facilitate the transition/commercialization of technologies generated through the SBIR program. Since East Asian Countries tend to have strong bases of manufacturing (and export), they paid attention to the role of small businesses in their economies and emphasized technology transition to advance their manufacturing technologies. In spite of such an importance of the SBIR program, there has been relatively little research on East Asian SBIR programs when compared to the U.S. and little research on comparing East Asia with the U.S. in the vein of SBIR programs. Even in the U.S., most studies focus on the evaluation of their own SBIR program and rarely look into the program formulation in a systematic manner. Moreover, there are few studies that take into account the Obama administration's recent emphasis on technology commercialization and manufacturing in the context of SBIR program.

[4] These countries each replicated the U.S. SBIR program around 1999.

[5] KOSBIR. Information available at http://www.smba.go.kr/kr/policy/support/supportView.do?mc=usr0001048& brd_id=A 04000&seq=275

3. METHODOLOGY AND APPROACH

3.1. Approach

To address my research questions, the study first examined the U.S. SBIR program, including its history, the recent Reauthorization Act, and how major East Asian countries (Japan, Korea and Taiwan) adopted the program. Particularly, the study focused on the recent emphasis on the technology transition/commercialization and manufacturing. Through extensive and systematic literature review, the study summarized the historical and legal components of the SBIR program, including the Reauthorization.

Second, the study identified who are participants and what processes underlie in the SBIR-related political arena, in particular the recent SBIR Reauthorization. To systematically approach this issue, the study employed Kingdon (2003)'s framework—his political theory and Garbage Can Model. Based on the components of the framework, the study compared the U.S. with East Asian countries.

Third, the study looked into how the SBIR-related policy window could be opened in terms of political participants and processes. The study examined what influences were involved in the successful reauthorization of the U.S. SBIR program, considering government policy agendas with the recent emphasis on the technology transition/commercialization and manufacturing.

Finally, the study drew out SBIR-related policy implications for East Asian countries, based on the U.S. case and political differences between the U.S. and East Asia. Using the aforementioned analysis outcomes, the study distilled policy recommendations on how to set, implement, and evaluate the SBIR program.

3.2. Analysis Framework

The study mainly adopted a qualitative and normative approach rather than a quantitative and exploratory one. Thus, it entailed extensive literature review and conducted case study of practices of the U.S. and East Asian countries. For systematic and exhaustive analysis, the study adopted Kingdon (2003)'s framework and compared SBIR-related political aspects of the U.S. and East Asia.

Attempts have been made to understand national innovation systems (NISs) in terms of functions and interactions of actors in the systems (Chang & Shih, 2004). Although there are many variations, a great body of studies on NISs is based on OECD studies in which major institutions, functions (OECD, 1999), and interactions (OECD, 1997) are described. The table below compares the basic framework of OECD and its variation example, Chang and Shih (2004).

TABLE 2. Comparison Criteria of NISs

	OECD studies	Chang and Shih (2004)
Major institutions	Government, enterprises, universities, public and private research institutes, bridging institutes, and other contributing institutions	
Six functions	Policy formulation, performing R&D, financing R&D, promotion of human resource development, technology diffusion, and promotion of technological entrepreneurship	Policy formulation, performing R&D, financing R&D, promotion of human resource development, technology bridging, and promotion of technological entrepreneurship
Four main interactions	Joint industry activities, public/private interactions, technology diffusion, and personnel mobility	R&D collaboration, informal interaction, technology diffusion, and personnel mobility

Source: OECD (1997; 1999), Change & Shih (2004)

This framework is useful for comparing NISs of multiple countries, but it is most appropriate for conducting analysis of a comprehensive system rather than one specific function—e.g. policy formulation—within it. Since this study focused specifically on SBIR program formulation (in the political context) while considering other functions as well as major institutions and their interactions, the study employed another framework—Kingdon (2003)'s framework—which is tailored to policy formulation.

TABLE 3. Kingdon's Framework

Participants	Visible	President, Congress, Media, and Parties
	Invisible	Experts, Bureaucrats, and Staffers
Processes: Garbage Can Model	Problem Recognition	Systematic Indicators, Disasters and focusing events, Feedback
	Policy Generation	Technical feasibility, Budget workability, Dominant values, Political support
	Politics	National mood and public opinion, Legislative and Administrative Changes, Interest group campaigns

Source: Kingdon (2003)

3.3. Data

The study primarily used secondary data: (1) SBIR program evaluation reports from the U.S. National Research Council (US-NRC), US-GAO, and the RAND Corporation; (2) Presidential initiatives from various websites such as "Startup America" and "Advanced Manufacturing Partnership"; (3) international small business R&D data and political activities data from APEC, the OECD, World Bank, government agencies of interest and their think tanks. Furthermore, the study tapped into various survey data to fill gaps in problem, policy, and politics streams of the Garbage Can Model. For the cross-country comparison of these three streams, Global Entrepreneurship Monitor (GEM) data, Hofstede Cultural Domains data, and World Value Survey data were utilized, respectively.

4. U.S. SBIR PROGRAM

4.1. Overview

The SBIR program was the first public venture program in the United States. After a US-NSF pilot program in 1977, SBIR programs spread across several government agencies following the passage of the Small Business Innovation Development Act of 1982. The Act mandates that all federal agencies with extramural research budgets above certain threshold values (e.g. $100 million) must set aside a percentage (e.g. 2.5%) of their budget for small businesses R&D. Using the set-aside public money, the SBIR program is intended to: (1) stimulate technological innovation; (2) use small businesses to meet federal R&D needs; (3) foster and encourage participation by minority and disadvantaged people in technological innovation; and (4) increase private-sector commercialization of innovations derived from federal R&D (Schacht, 2012).

The SBIR program consists of three connected phases. The first phase is intended for small businesses to identify the technical feasibility of their ideas, and to assess the impact of any resultant technologies. This phase lasts approximately six months and provides between 100,000 and 150,000 USD. Principal R&D takes place in the second phase, allowing small businesses to fully develop their technologies. This phase typically lasts two years, and provides small businesses between 750,000 and 1 million USD. The third phase is for commercialization of technologies developed in the second phase. Unlike previous phases, the third phase does not involve SBIR funds, but encourages small businesses to seek support from venture capital and procurement funds (SBA, 2014).

TABLE 4. SBIR Program Process Relative to Innovation Process

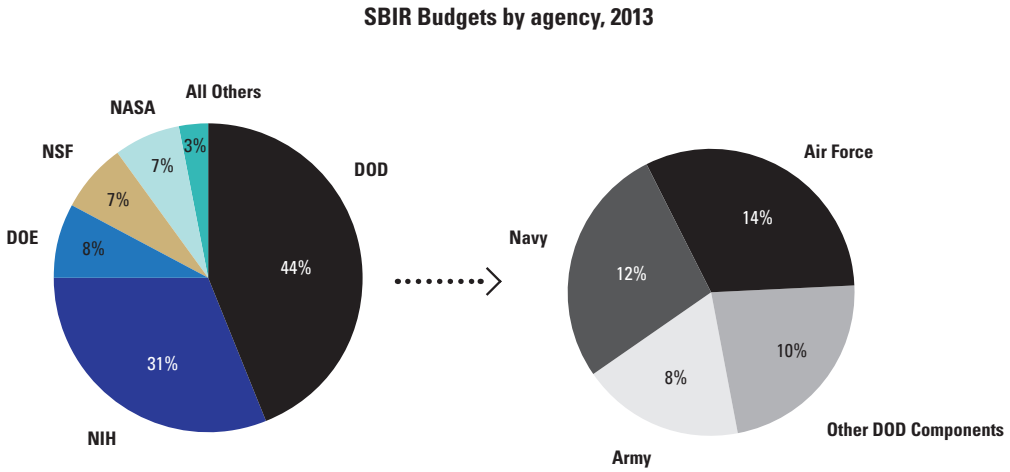
SBIR	Phase I: 6 months / $150K		Phase II: 2 years/$1M	Phase III: Non-SBIR	
Innovation	Pre-concept refinement	Concept refinement	Technology development	System development and demonstration	Production and deployment

Source: Flake (2010), compiled by author

The SBIR program is primarily administered by the US-SBA, which issues policy directives for the program and the annual report to Congress. However, the program funding comes from and is independently managed by participating agencies that have more than 100 million USD in extramural R&D budgets: US-DOD; US-NIH under the U.S. Department of Health and Human Service (US-DHHS); US-NSF; U.S. Department of Energy (US-DOE); U.S. National Aeronautics and Space Administration (US-NASA); U.S. Department of Homeland Security (US-DHS); U.S. Department of Agriculture (US-DA); U.S. National Oceanic and Atmospheric Administration (US-NOAA) and U.S. National Institute of Standards and Technology (US-NIST) under the U.S. Department of Commerce (US-DOC); U.S. Department of Transportation (US-DOT); U.S. Environmental Protection Agency (US-EPA); and U.S. Department of Education (US-ED).

Total budget of the U.S. SBIR program exceeds 2 billion dollars. Of SBIR-participating agencies, the US-DOD (approximately 900 million USD, 44%)—consisting of Air Force (14%), Navy (12%), Army (8%), and other DOD components (10%)—has the largest SBIR budget, followed by the US-NIH (approximately 600 million USD, 31%), US-DOE (8%), US-NSF (7%), and US-NASA (7%).

FIGURE 1. SBIR Budgets by Agencies, 2013



Source: Oliver (May 28, 2013), compiled by author

4.2. Assessment

Since the SBIR program involves a large amount of public funds, it was evaluated on several occasions. The US-NRC of the National Academies assessed the overall SBIR program, as well as the programs of federal agencies in response to Congressional request. To date, the NRC has conducted an assessment of the SBIR programs of the US-DOD, the US-NSF, the US-NIH, the US-DOE and the US-NASA, most of which occurred during the 2007-2009 time period (National Research Council, 2008). While these assessments provide a comprehensive overview of the SBIR program, and an analysis of a SBIR awardees survey, they lack the description of program formulation such as political participants and processes, and specific policy recommendations.

The U.S. Government Accounting Office (US-GAO) also published assessments of the SBIR program, which contain qualitative analysis (rather than quantitative) to address policy problems of the current SBIR system. US-GAO reports emphasize the establishment of a SBIR technology transition database so as to evaluate the effectiveness of the SBIR program, in particular the commercialization of technology of SBIR awardees (GAO, 2013).

The RAND Corporation conducted assessments of US-DOD-specific SBIR programs as well. In the first report, RAND evaluates US-DOD's SBIR program, and provides recommendations for improvement (RANDHeld, Edison, Lawrence, Pfleeger, Antón, & Clancy, 2006). In the following report, RAND estimates the administrative cost associated with US-DOD's SBIR program (RAND-Seong, Horn, & Held, 2008). The most recent RAND report focuses on the treatment effect of US-DOD's SBIR program on technology transition (Edison, 2010). These studies use both qualitative and quantitative approaches but focus on program evaluation rather than program formulation and do not fully address the commercialization aspects of the SBIR program.

The academic community is also interested in the SBIR program. In particular, economists seek to measure the economic effect of the SBIR program using econometric techniques despite limited data. Lerner (2000) finds that SBIR awardees are more likely to increase jobs and revenues and to get funded from Angel and venture capitals. In addition to Audretsch (2003), Lerner (2000), Audretsch, Weigand, and Weigand (2002), Audretsch (2003), Huang, Lee, and Chu (2004), Lerner (2000), Link and Scott (2010; 2009), Link and Scott(2010), and Siegel and Wessner (2012) examine the effect of the SBIR program in terms of private-public partnership and innovation-related risk sharing.

In contrast, other studies are concerned with the negative aspects of the SBIR program. Wallsten (2000) considers the crowding-out effect of the SBIR program, in which SBIR awardees invest less money in R&D than what they would have without SBIR funding, and thus private R&D expenditure is transferred to the government. Moreover, Gans and Stern (2003) posits that SBIR managers are tempted to select small businesses in industry areas where private funding is available, but neglect small businesses in areas that are socially needed yet do not have sufficient private funding.

Overall, an extensive body of literature sheds light on SBIR issues. Some researchers examine SBIR in the context of program evaluation to draw out policy recommendations, while others conduct empirical analyses to statistically test the economic impact of the SBIR program. Yet, all of the program evaluations are performed at the agency level (e.g. US-DOD level) on domestic issues, and thus do not reflect cross-country characteristics from the global perspective. Some literature deals with technology transition-related issues, but do not consider how those issues contribute to the formulation of the recent policy agenda—i.e., the SBIR Reauthorization. Furthermore, no literature accounts for political aspects of the SBIR program.

4.3. Spillover

Thanks to the positive assessments of the U.S. SBIR program, conducted by US-NRC, US-GAO, RAND and other scholars, as well as tangible performance, the program has expanded domestically and has been welcomed internationally. Internally, the SBIR program budget continues to increase, while externally more and more countries have expressed their interests in the program. In addition to the three East Asian countries, other Asian countries (e.g., India) as well as European countries (e.g., The United Kingdom, the Netherlands, Sweden, and Russia) have adopted SBIR-type pro-

grams to assist in the technology development of small businesses. The following table summarizes the SBIR programs of the U.S. and East Asian countries. Furthermore, there is an attempt to replicate and apply SBIR program concepts to areas other than technology. One example is the Social Spending Innovation Research (SSIR) Program, proposed by the Coalition for Evidence-Based Policy (2015) in the U.S., which aims to solve social problems innovatively in areas such as education, poverty, and well-being.

TABLE 5. Summary of SBIR Programs of the U.S. and East Asian Countries

	U.S.	Japan	Korea	Taiwan
Program name	SBIR	SBIR	KOSBIR[a]	SBIR
Start date	1982	1999	1998	1999
Management agency	US-SBA	Small and Medium Enterprise Agency, Ministry of Economy, Trade and Industry (METI)	Small and Medium Business Administration (SMBA), Ministry of Trade, Industry and Energy (MOTIE)	Small and Medium Enterprise Administration (SMEA), Ministry of Economic Affairs (MOEA)
Participating agencies	12 federal agencies	13 government agencies	13 government agencies and 6 public corporations	Central government agencies and local governments
Selected research and technology fields	No specific thematic focus	Energy, environment, information technology and communications, medical devices, agriculture and foods, bio and medical sciences	20 strategic areas, including green manufacturing and advanced fusion technology	Electronics, communication, mechanics, livelihood, biotechnology, technology alliance, service, service alliance, and digital content

Note: KOSBIRa = Korea Small Business Innovation Research Program
Source: OECD (2010), ERAWATCH (2015), SMEA (2014)

5. REAUTHORIZATION OF THE U.S. SBIR PROGRAM: KINGDON'S FRAMEWORK

Since the U.S. SBIR program was initiated by the Small Business Innovation Development Act of 1982, Congress passed two major acts—The Small Business Research and Development Enhancement Act of 1992 and The Small Business Innovation Research Program Reauthorization Act of 2000—and multiple extensions. Most recently, on December 31, 2011 the program was reauthorized for 6 more years. Unlike other contentious bills governing federal R&D programs, the SBIR program was favorably supported by both Democratic and Republican parties.

Of several reauthorizations, the study focused on the most recent one (see TABLE 6 for the key changes) and analyzed it from the political perspective. Specifically, the study regarded the reauthorization as a policy window, and identified participants and processes that contributed to the success of SBIR program reauthorization.

TABLE 6. Key Changes with the Recent SBIR Reauthorization

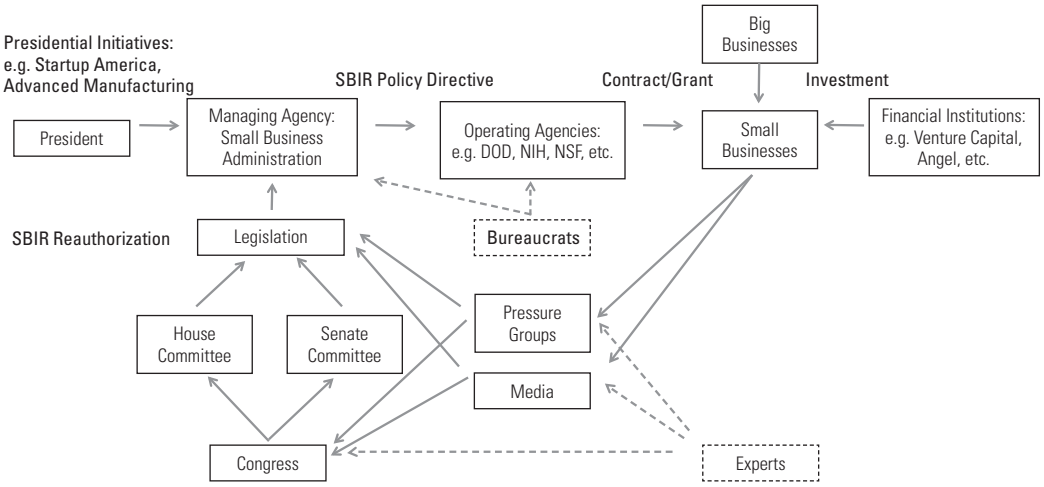
Funding	• Set-aside percentages are increased - SBIR set-aside increased to 2.6% for FY 2012 - SBIR share will increase by 0.1 percentage point each fiscal year until it reaches 3.2% for FY 2017. - Agencies may exceed these minimum percentages. • Award Sizes - Awards may not exceed guideline amounts by more than 50% ($225,000 for Phase I and $1.5 million for Phase II). Agencies must receive a special waiver from US-SBA to exceed guideline amounts by more than 50%. • Technical Assistance - The amount of SBIR funds permitted for technical assistance raised from $4000 to $5000 per award per year.
Eligibility	• Cross-agency Awards - Phase I awardee may receive a Phase II award from an agency other than the one that awarded the related Phase I. • Direct to Phase II pilot - FY 2012-2017 US-NIH, US-DOD, and US-ED may issue Phase II SBIR awards to firms to pursue Phase I solicitation topics without requiring a Phase I. - Implementation is at agency discretion. • Open Phase II competition - Agencies must allow all Phase I awardees to apply for a follow-on Phase II award. Issuing Phase II awards via invitation only will not be permitted. - Agencies must include information on the Phase II application process in all Phase I solicitations. • Second Phase II - Agencies may award a second, sequential, Phase II to continue a Phase II project. • Commercialization standards for Phase I applicants - Phase I to Phase II Transition Rate: Phase I applicants are required to meet agency-specific standards for progress towards Phase II. - Phase II to Phase III Commercialization Rate: Phase I applicants that win SBIR Phase II awards, are required to meet agency-specific standard of commercialization success from those Phase II awards.
Streamlining award process	• Streamlining the award process - Act requires changes aimed at reducing gaps in time between close of the solicitation and notification of award. Agencies are to implement these measures as soon as is practicable. - Policy Directives include new reporting requirements to develop data needed to monitor and analyze time lags
Increased support for commercialization	• Technical assistance (TA) - Amounts increased to $5000, flexibility on use • Commercialization Readiness Programs (CRP) - US-DOD Commercialization Readiness Pilot is made permanent; Commercialization Readiness Pilot programs for civilian agencies are authorized allowing agencies to use up to 10% of SBIR funds to support commercialization and Phase III efforts. • Phase III preference - Agencies directed to support SBIR awardees in their efforts to commercialize SBIR work through, among other things, Phase III sole-source contracts.
Etc.	New requirements on data and reporting; New measures to guard against fraud, waste, abuse

Source: SBA (April 23, 2014)

5.1. Participants

In SBIR-related activities there are many visible and invisible participants. As Kingdon (2003) mentioned, the President, Congress, Media, and Parties are visible participants while Experts, Bureaucrats, and Staffers are invisible. President Obama influences the SBIR program through presidential initiatives such as Startup America and Advanced Manufacturing, and through SBIR Policy Directives via US-SBA while Congress is authorized to pass SBIR reauthorizations. Both the President and Congress are impacted by pressure groups and the media. Although experts and bureaucrats are less noticeable, they inform decision makers such as US-SBA. Overall activities related to the SBIR program are described in the following figure.

FIGURE 2. SBIR-related Actors and Activities



Source: Adapted from Kesan and Gallo(2009)

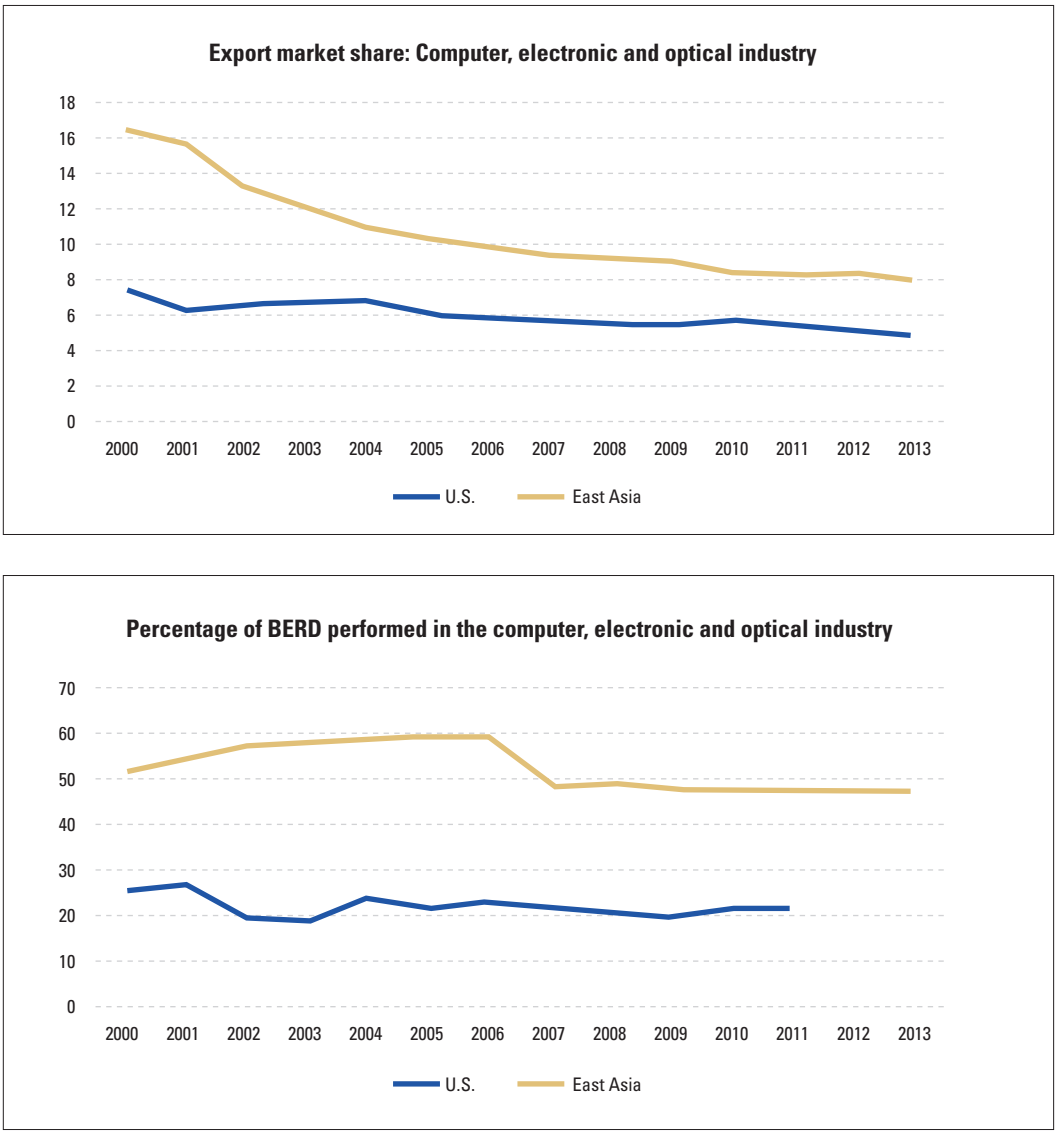
5.2. Processes

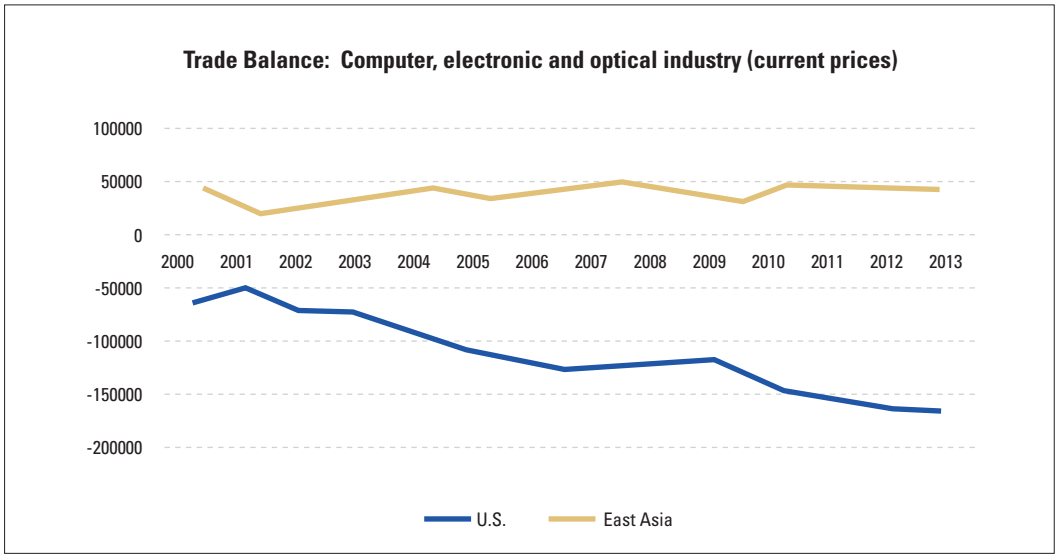
5.2.1. Problem Stream

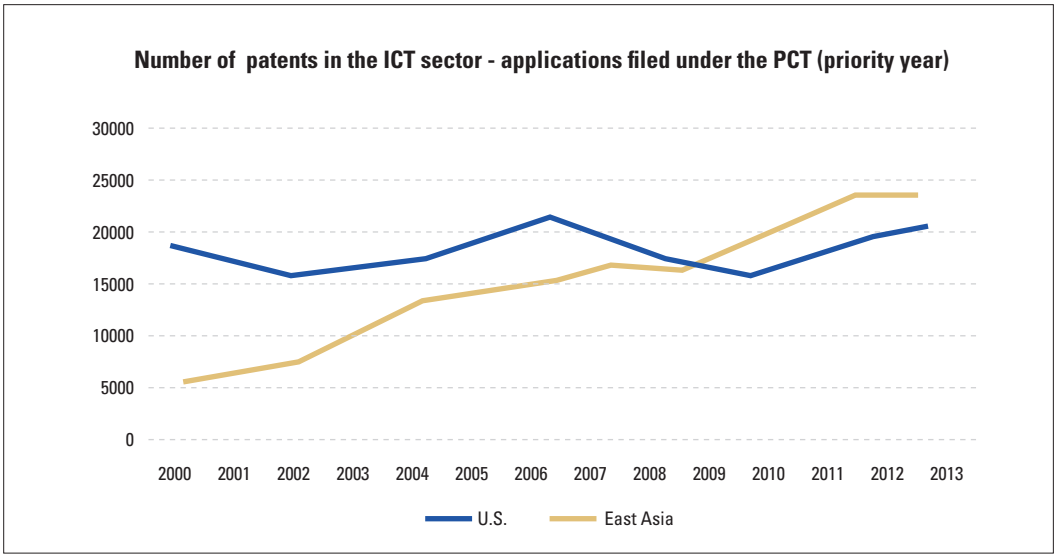
The U.S. SBIR program was created in response to Congress's concern over the 1970s-80s' recession and competitiveness challenges posed by Japan and Germany in the areas of automobiles and machine tools (Tibbetts, May 28, 2008). The Reauthorization can be understood in this context, but in different industries. Since high-tech industries tend to contribute more significantly to today's economy, the ICT industry is a good place to start discussing competitiveness issues. The figure below shows systematic indicators explaining what challenges the U.S. confronted and why Congress supported the Reauthorization. When compared to East Asia, the U.S. shows a decreasing export market share and relatively low percentage of BERD (Business Enterprise Expenditure on R&D)

performed in ICT industry. Moreover, the U.S. trade balance in the ICT industry has worsened. PCT patent applications filed by the U.S. were surpassed by the total number filed by the three East Asian countries.

FIGURE 3. Indicators Related to the U.S. SBIR Program Reauthorization







Note: East Asia = Average of Japan, Korea, and Taiwan (thereafter), except the last figure for the number of patents in the ICT sector (East Asia = Sum of Japan, Korea, and Taiwan)
Source: OECD[6] , compiled by author

[6] OECD Main Science and Technology Indicators (MSTI). Available at http://stats.oecd.org/Index.aspx?Data SetCode=MSTI_PUB

5.2.2. Policy Stream

Key changes with the Reauthorization were roughly evaluated using criteria presented in the policy stream—technical feasibility (feasibility of implementation), budget workability (tolerable cost), dominant values (value acceptability within the policy community, e.g. national ideology, equity, and efficiency), and political support (public acquiescence and receptivity of elected officials)—which were essential for program survival or bill passage. The following table indicates that overall assessment of the Reauthorization largely ranged from medium to high, suggesting that the Reauthorization was more likely to be accepted by the political participants.

TABLE 7. Program Assessment of the SBIR Reauthorization

Key changes with the Reauthorization	Technical feasibility	Budget workability	Dominant values	Political support
Funding	**High** No/little technical difficulty	**Low** Budget increase rate (0.1%/year) financially burdensome	**High** Consensus on supporting small business	**Medium** Agree with the importance of small business R&D, but public investment in private businesses may incur political opposition
Eligibility	**Medium** Need to build and maintain company registry/awards database	**High** No/little money involved	**Medium** Diversifying funding mechanisms is important, but needs to prevent false reporting	**Medium** Limitation on eligible awardees is needed but, on the other hand, needs to facilitate awardees' successes
Streamlining award process	**High** No/little technical difficulty	**High** No/little money involved	**High** Efficiency	**High** Support cutting red tapes
Increased support for commercialization	**High** No/little technical difficulty	**Medium** Moderate amount of money needed for TA and CRP	**High** Consensus on the importance of commercialization	**High** Support economy stimulus

Note: Scales (High-Medium-Low) used here indicates to what extent the Reauthorization is preferred.

5.2.3. Politics Stream

According to Kingdon (2003), the politics stream focuses on how political events—including, national mood and public opinion, legislative and administrative changes, interest group campaigns—build circumstances for policy change. The following table summarizes the politics stream related to the SBIR Reauthorization.

TABLE 8. Politics Stream of the SBIR Reauthorization

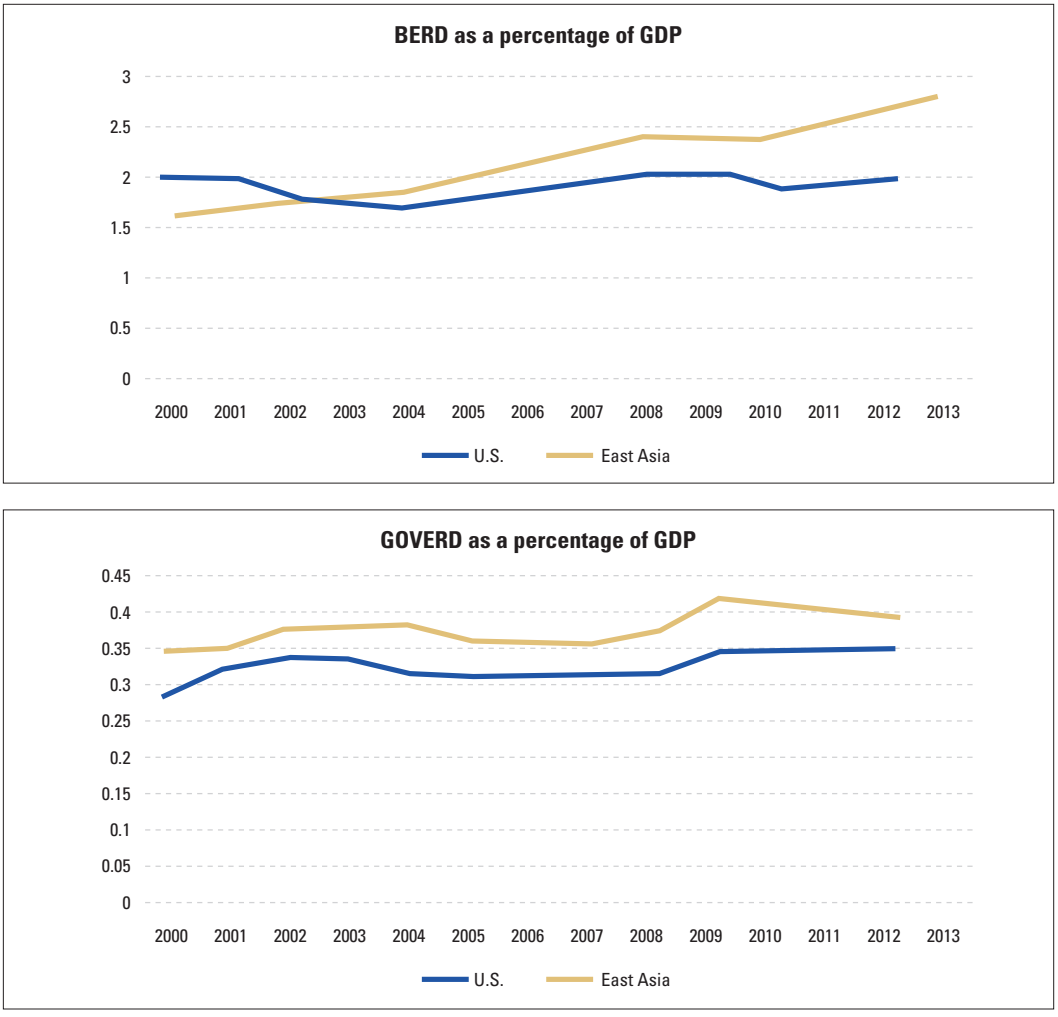
National mood and public opinion	According to the World Value Survey, the U.S. public tends to believe that the world is better off because of science and technology and to more aggressively support political actions (see Comparative Analysis section). Moreover, the public recognizes that small business innovations create jobs and contribute to the national economy.
Legislative and administrative changes	The Obama Administration places emphasis on entrepreneurship, technology commercialization, and manufacturing, all of which are closely related to SBIR program and its reauthorization (The White House, 2011).
Interest group campaigns	Pressure groups such as Biotechnology Industry Organization (BIO) and the National Venture Capital Association (NVCA) called for and lobbied for key changes in the Reauthorization (Tibbetts, May 28, 2008).

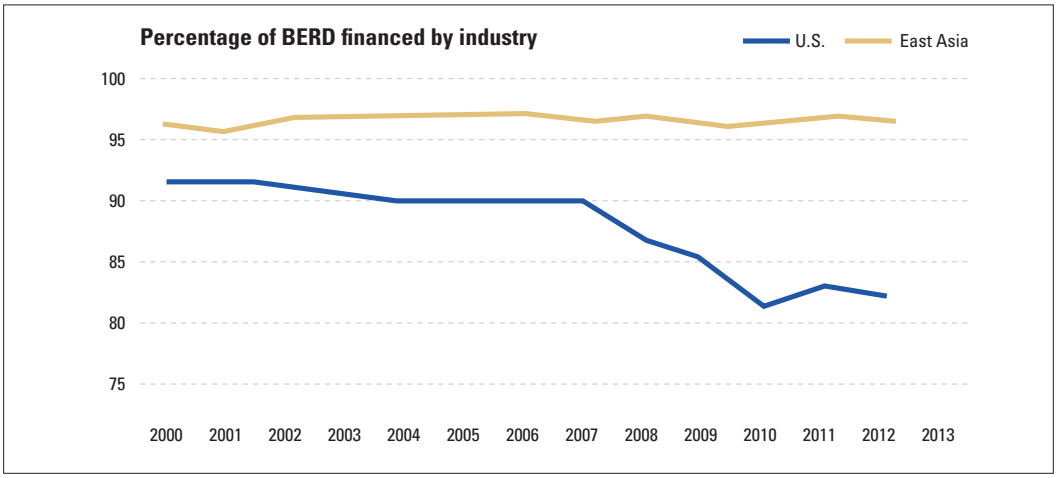
6. COMPARATIVE ANALYSIS: PARTICIPANTS AND PROCESSES

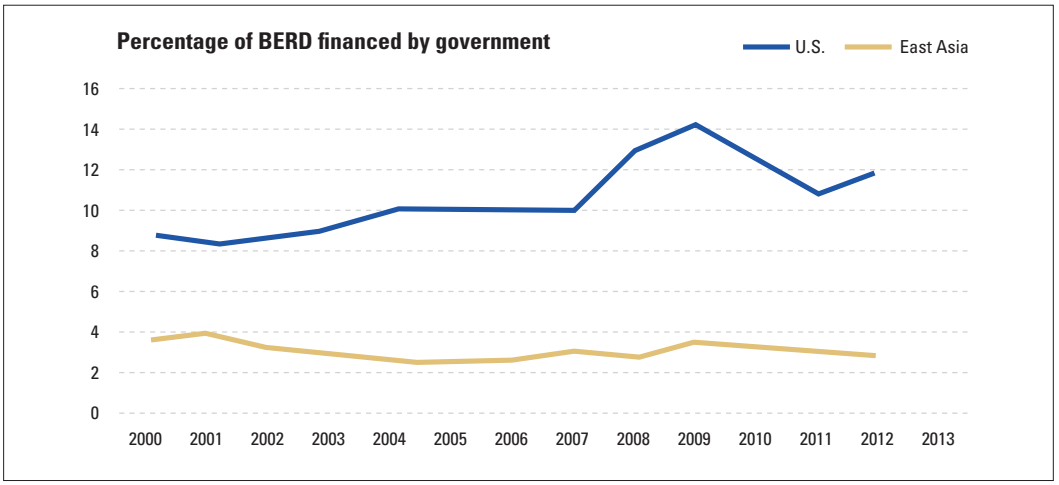
6.1. Participants: U.S. vs. East Asian Countries

In the arena of SBIR programs, the major visible participants are governments and businesses. For the cross-country comparison, the study used the OECD database and presented both business and government R&D expenditures as a percentage of GDP. According to the figure below, East Asian countries invested more money in R&D in proportion to GDP than the U.S. Taking a close look at the composition of private R&D (BERD), much more BERD was financed by government in the U.S. than East Asia while much less was financed by industry. The difference might be attributable to more frequent public-private partnership in the U.S than in East Asia.

FIGURE 4. Percentage of R&D by Industry and Government: U.S. vs. East Asia







Note: BERD = Business Enterprise Expenditure on R&D; GOVERD = Government Expenditure on R&D
Source: OECD[7], compiled by author

Another important actor that indirectly influences SBIR programs (invisible participants) is experts, specifically from academia. To take this into account, the study used the Web of Science database to roughly gauge how many SME- or SBIR-related publications were produced. Using keywords and authors' addresses[8], the number of publications was identified. As shown in the following, the U.S. produced much more SME- and SBIR-related publications than East Asia.

[7] OECD Main Science and Technology Indicators (MSTI). Available at http://stats.oecd.org/Index.aspx?DataSetCode =MSTI_PUB

[8] One example of search terms used are as follows: TI=("small business" or SME or "small and medium sized enterprise" or "small and medium size enterprise" or "small firm" or "small company") and CU="USA"; Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, CCR-EXPANDED, IC; Timespan=All years

TABLE 9. Number of Publications Related to SME and SBIR

Number of publication	U.S.	East Asia			
			Japan	Korea	Taiwan
SME-related	1,245 (43.8)	102 (10.2)	46 (8.6)	29 (8.7)	27 (20.7)
SBIR-related	71 (2.5)	2 (0.2)	0 (0)	2 (0.6)	0 (0)

Note: Values in parenthesis indicate the number of publications per million SME establishments (or enterprises)
Source: Web of Science, searched by author on February 1, 2015; SBA (2015); METI (2014); K-BIZ (2014); and SMEA (2014)

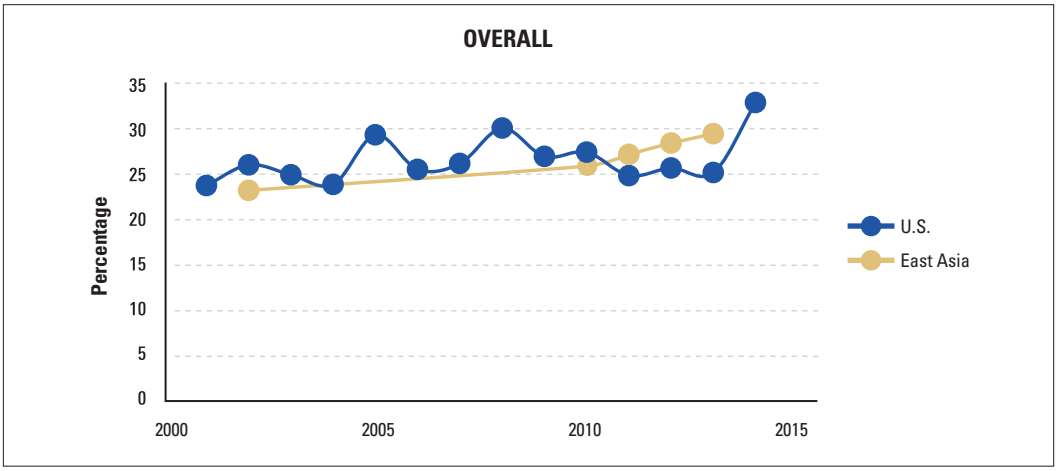
6.2. Processes: U.S. vs. East Asian Countries

For the purpose of comparison between the U.S. and East Asian Countries, the study utilized representative data for each stream instead of comprehensive analysis of each stream's components.

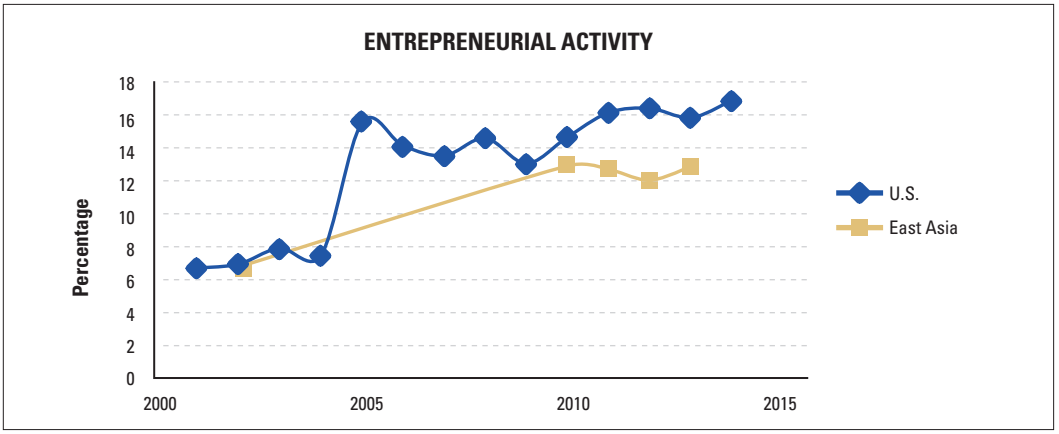
6.2.1. Problem Stream

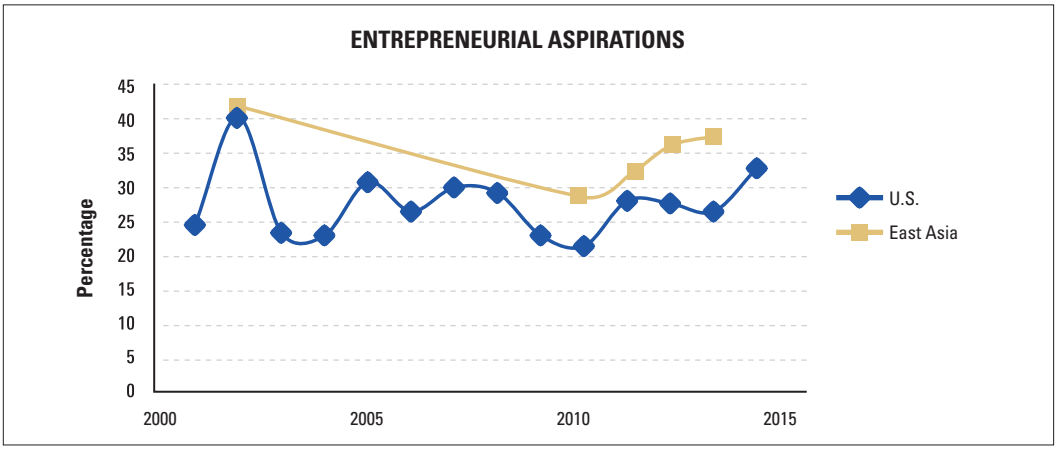
Since the SBIR program is closely related to entrepreneurship—the outcomes of SBIR programs lead to entrepreneurial activity—the study utilized entrepreneurship-related indicators as a problem recognition process. For the problem stream, specifically the study used Global Entrepreneurship Monitor (GEM) indicators to compare the U.S. with East Asian countries in terms of their entrepreneurial activities, entrepreneurial aspirations, and entrepreneurial attitudes[9] . According to the figure below, overall entrepreneurship of East Asia had gradually increased since 2000 while that of the U.S. had stagnated but recently bounced back. The U.S. showed higher level of entrepreneurial activity and attitude than East Asia while having lower levels of entrepreneurial aspiration.

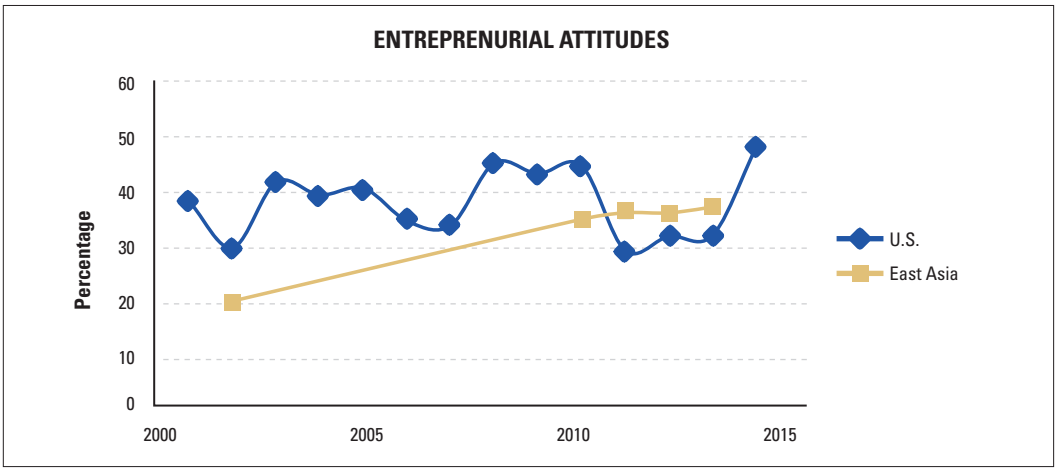
FIGURE 5. Comparison of GEM Results: U.S. vs. East Asia



[9] See Appendix for detailed explanation.







Note: East Asia = Average of Japan, Korea, and Taiwan; Missing data points of East Asia were interpolated
Source: GEM[10] , compiled by author

[10] Global Entrepreneurship Monitor. Available at http://www.gemconsortium.org/

6.2.2. Policy Stream

To understand policy generation-related components such as technical feasibility and dominant values, cultural dimensions were taken into account. Culture is used in cross-country studies on technology and innovation diffusion/adoption. For instance, Erumban and De Jong (2006) examine how cultural aspects influence the adoption rates of information and communications technology. Gretzel, Kang, and Lee (2008) look into how cultural dimensions impact consumer-generated media, such as blogs and podcasts, adoption and use. General outcomes of both studies are summarized in the following table. Following the two studies that use Hofstede's cultural dimensions, the study examined those of the U.S. and East Asia.

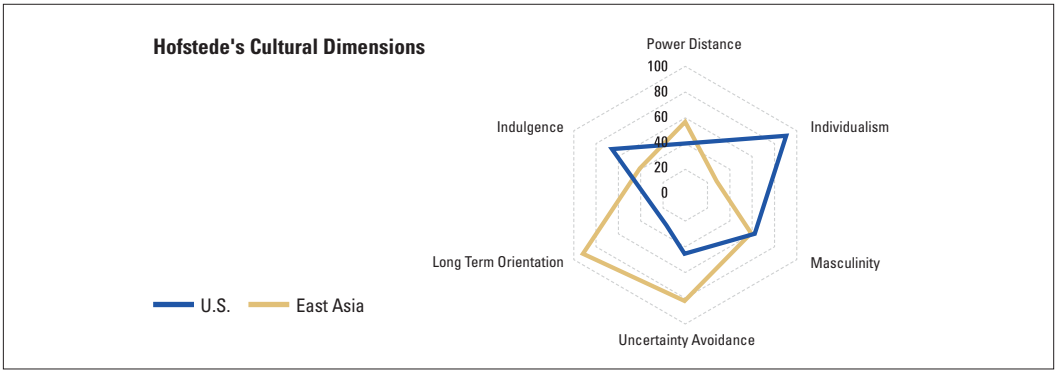
TABLE 10. Hofstede Cultural Dimensions and Relationship with Innovation

Cultural dimensions	Definition	Relationship with innovation
Power Distance (PD)	Inequality of the distribution of power in a country (e.g. centralized vs. decentralized, leadership style)	Negative: (+) PD→ (-) IA
Uncertainty Avoidance (UA)	Degree to which members of a society feel uncomfortable with uncertainty and ambiguity	Negative: (+) UA→ (-) IA
Individualism (IM)	Relation between the individual and the group to which that individual belongs	Positive: (+) IM→ (+) IA
Masculinity (MY)	Competition, ambition, focus on performance and material value	Positive: (+) MA→ (+) IA
Long-term Orientation (LO)	To what extent a culture values its traditions and how much it focuses on its past and future	Negative: (-) MA→ (+) IA
Indulgence (IE)	To what extent a society allows relatively free gratification of basic and natural human drives	Not determined yet

Note: IA = Innovation Adoption
Source: The Hofstede Centre[11] , Erumban and de Jong (2006), and Gretzel, Kang, and Lee (2008)

Cultural differences between the U.S. and East Asian were salient in individualism, long term orientation, and uncertainty avoidance while they were moderate in power distance and indulgence, with no difference in masculinity (see FIGURE 6). The higher level of individualism and lower levels of uncertainty avoidance and long-term orientation of the U.S. suggested that the U.S. had a more innovation-valuing culture than East Asia.

FIGURE 6. Hofstede's Cultural Dimensions: U.S. vs. East Asia



Source: The Hofstede Centre, compiled by author

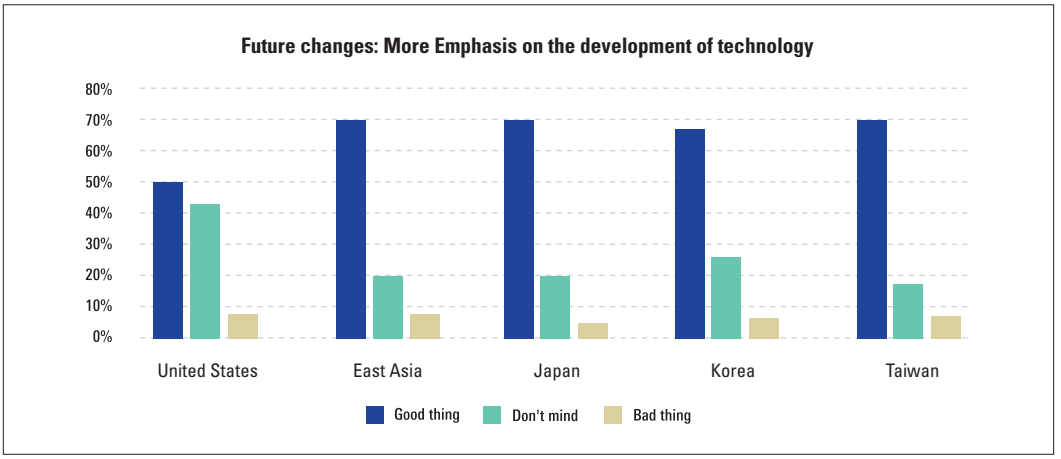
6.2.3 Politics Stream

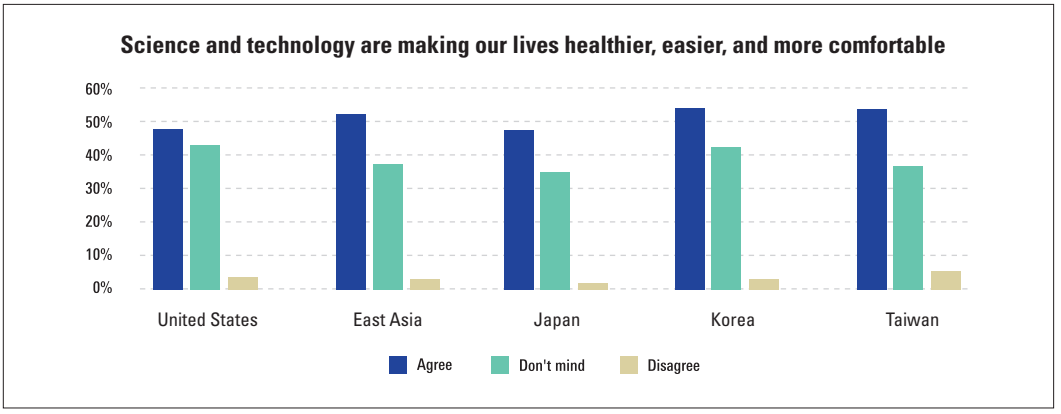
For the politics stream, the study tapped into World Value Survey (WVS)[12] on technology and politics, since national mood and public opinion play an important role in the stream. In the survey, technology-related questions include:

- Future changes: More emphasis on the development of technology
- Science and technology are making our lives healthier, easier, and more comfortable
- Because of science and technology, there will be more opportunities for the next generation
- The world is better off, or worse off, because of science and technology.

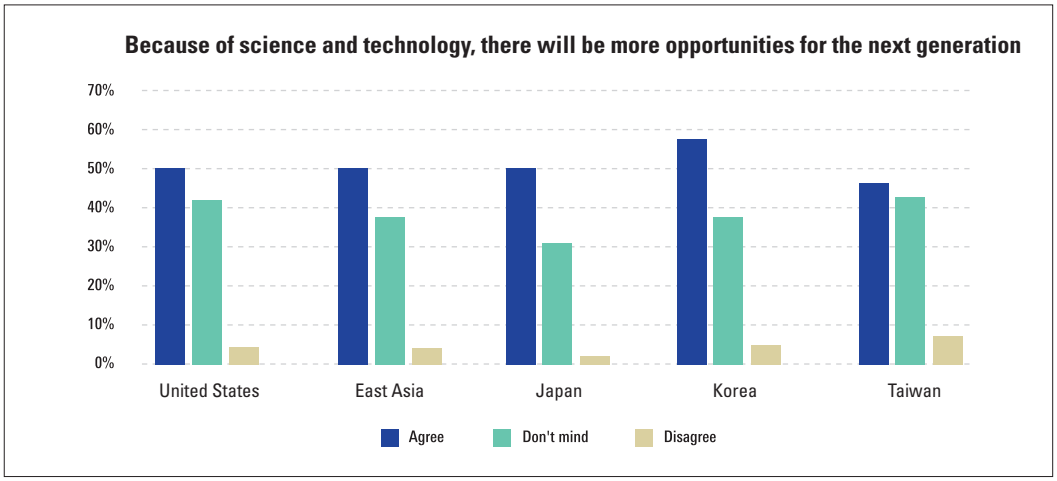
Looking at the following figure on technology, East Asian countries were much more inclined to underscore technology development for future changes than the U.S. while both recognized the role of science and technology in future opportunities.

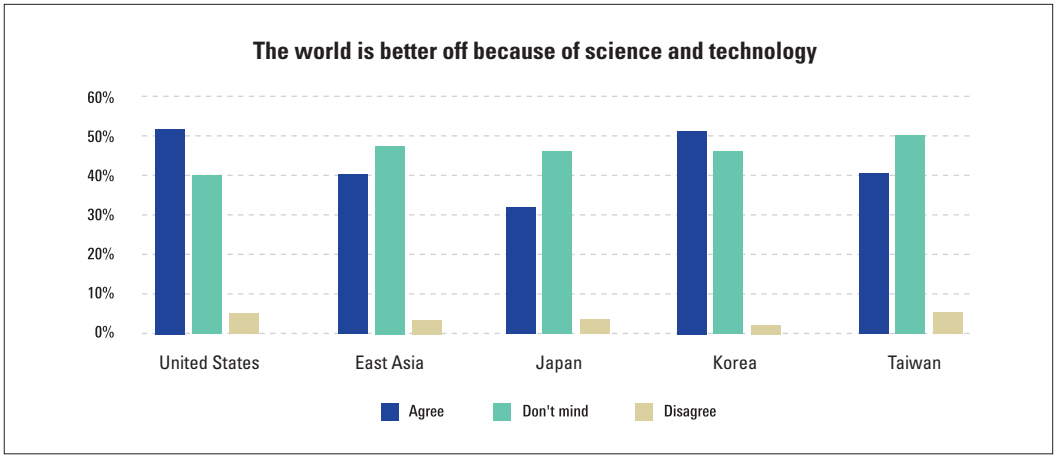
FIGURE 7. National Mood and Public Opinion on Technology





[11] The Hofstede Centre. Available at http://geert-hofstede.com/index.php
[12] World Value Survey. Available at http://www.worldvaluessurvey.org/





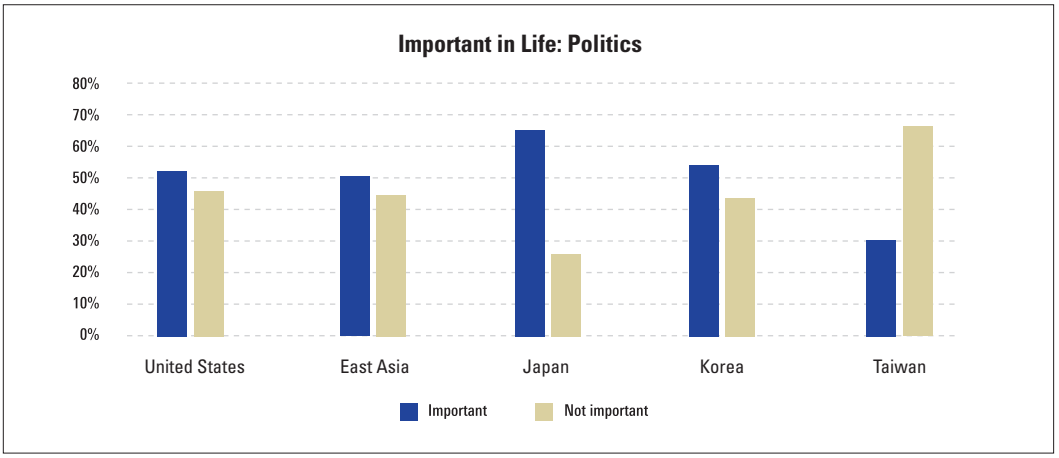
Source: WVS—U.S. (2011), Japan (2010), Korea (2010), and Taiwan (2012), compiled by author

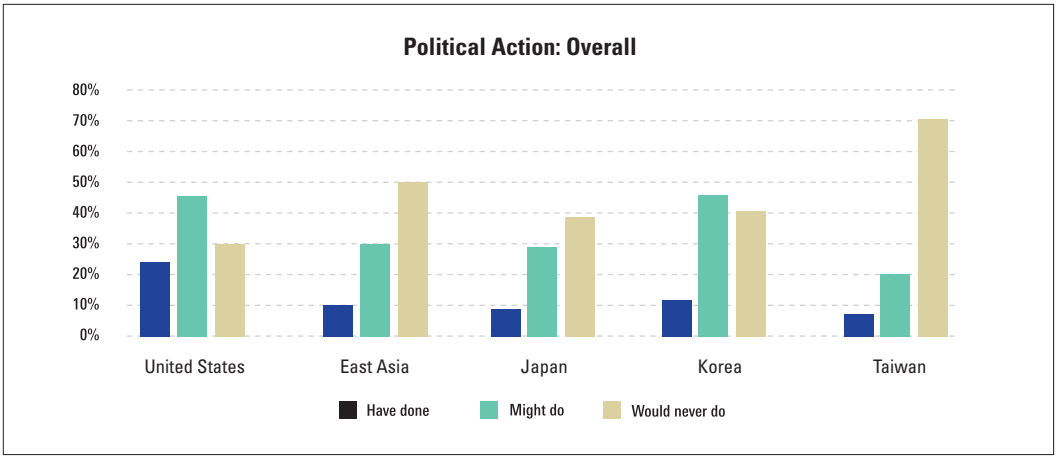
In the survey, politics-related questions include:

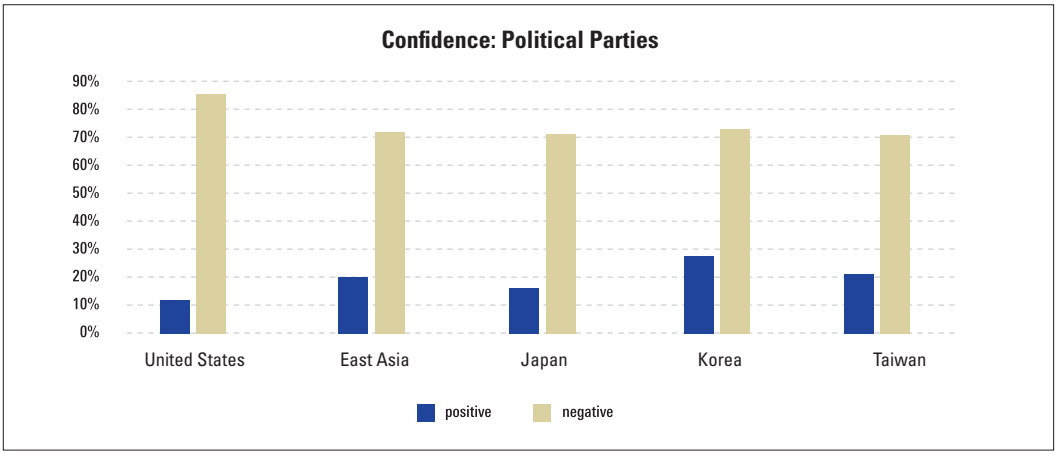
- Important in life: Politics
- Political action: Signing a petition; Joining in boycotts; Attending peaceful demonstrations; Joining strikes
- Confidence: Political Parties
- Political system: Having a strong leader who does not have to bother with parliament and elections; Having experts, not government, make decisions according to what they think is best for the country; Having the army rule; Having a democratic political system.

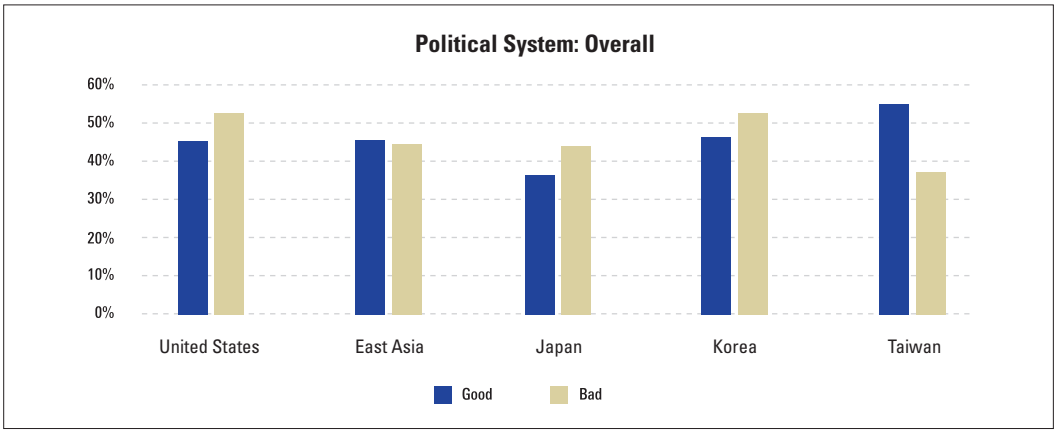
Looking at the following figure on politics, the U.S. was much more inclined to take political actions than East Asia while having less confidence in political parties. However, both put similar value on political system and politics in their lives.

FIGURE 8. National Mood and Public Opinion on Politics









Source: WVS, compiled by author

7. IMPLICATIONS

Based on the study, two policy implications for East Asia were found: one from the U.S. case itself (with a focus on the passage of the U.S. SBIR Program Reauthorization Act) and another from the political differences between the U.S. and East Asia.

7.1. Lessons from the U.S. SBIR Program

The U.S. is seeking to maximize the commercialization of technologies developed through the SBIR program. On the basis of the harmonization between visible political actors, the President and Congress extended the SBIR program six years more and incorporated various measures—e.g. budget increase, TA and CRP, etc.—to facilitate technology commercialization. As the program becomes bigger in size and more mature in age, more publications about SMEs and the SBIR program will allow invisible actors to participate in the political process. For example, comprehensive assessment reports, academic journals, think tank reports and congressional reports will contribute to improving the performance of the program.

In response to the U.S.'s aggressive actions to boost the rate of technology commercialization using small businesses and its competitiveness, East Asian countries should make bolder moves to further their localized SBIR programs and harvest more fruits from them, beyond just catching up with the U.S. Using the stronger executive power of their state structures and the fact that more jobs are created from small businesses, East Asian countries can:

- Assign larger budgets to their SBIR programs, e.g., more rapidly increase the percentage of SBIR allotments or earmark absolute amounts for SBIR expenditure;
- Provide greater assistance to SBIR awardees, e.g., offer technical and business assistance tailored to needs of each award; and
- Procure more products and services created through the programs, e.g., acquire more socially

beneficial technologies such as advanced military, environmental, and educational technologies from small businesses.

In addition to strong presidential commitments on small business innovation and technology commercialization, East Asian countries can improve the roles of political actors and reform the political processes related to the SBIR program by:

- Cultivating more informed bureaucrats with special knowledge of SBIR and funding more SME- or SBIR-related research (*participant side*);
- Building a more reliable database that enables decision-makers to keep track of SBIR awardees and their commercialization outcomes (*problem stream*);
- Prioritizing and allocating greater resources to the SBIR programs, combined with other SME, science and technology, and regional policies (*policy stream*); and
- Engaging more stakeholders such as industry experts and the public in SBIR planning and assessment (*politics stream*).

To enhance their competitiveness more fundamentally, on the other hand, East Asian countries should take flexible, adaptive, and robust (FAR) strategies (Davis and& Henninger, 2007), recognizing that they are facing substantial political challenges stemming from internal (e.g., skepticism about government-supported business R&D and redistribution of wealth created through SBIR programs) and external (e.g., geopolitical situation between G2 countries—U.S. and China) sources. Specifically, since East Asian countries have more volatile political atmospheres and higher dependence on international trade—both of which entail deep uncertainties by nature—relative to the U.S., East Asian countries should empower the SBIR programs in order to:

- Utilize the flexibility and adaptiveness of small businesses;
- Address uncertainties underlying R&D and commercialization efforts; and
- Adapt to a rapidly changing external environment.

7.2. Reflections on Political Differences Underlying SBIR Programs

With globalization, connectivity between countries has increased and thus changes in one country became readily transferable to other countries. Especially, technology and innovation policies and programs of the U.S. that have enhanced its economic and technological leadership for a long time have been imitated by faraway countries as well as neighboring ones. However, absorbing countries often borrow only the hardware features (e.g., SBIR program structure) of advanced or promising policies/programs, ignoring the software aspects (e.g., national culture underlying the SBIR program), and consequently fail to successfully internalize them. One example is Western automakers' attempts to transplant Japanese operations management without considering Japanese culture (e.g., Kennly & Florida, 1995, Martin & Siehl, 1983).

When the object of imitation is not physical products that businesses produce but rather policies and programs that governments formulate and implement, the political context underlies the software aspects. In this vein, the study provided a framework and a set of data that could be used when

one country decides to adopt other countries' policies and programs, in particular technology and innovation-related ones. As a case for that, the study examined the political differences between the U.S. and East Asia, which are summarized below:

Participant side

- East Asian countries invest more BERD and GOVERD as a percentage of GDP while investing less percentage of BERD financed by government than the U.S.
- East Asian countries produce fewer publications related to SME and SBIR than the U.S.

Process side

- According to GEM data on entrepreneurial activities, East Asian countries tend to have higher entrepreneurial aspiration while lower entrepreneurial activity and attitude than the U.S. (problem stream)
- Drawing on Hofstede's cultural dimensions, East Asian countries tend to bear higher long term orientation and uncertainty avoidance while lower individualism than the U.S. (policy stream)
- Based on WVS, East Asian countries tend to have greater expectations of technology development and higher confidence in political parties while participating less in political action than the U.S. (politics stream)

Given that the U.S. SBIR program has been developed and refined reflecting its own political situation, East Asian countries should take policy actions in order to facilitate the program to enroot into their countries and reap the full advantage of the program. In this vein, the study provides the following policy recommendations:

- In addition to increasing SBIR-related human and financial resources, East Asian countries should provide greater encouragement not only to SBIR but also to other PPP programs by increasing BERD funded by government and building a collaboration-friendly R&D environment (participant side);
- East Asian countries should improve entrepreneurs' access to resources (in particular, financial resource) in order to link their high entrepreneurial aspiration to actual entrepreneurial activities (problem stream);
- East Asian countries should cultivate failure-tolerating culture and risk-taking entrepreneurs, for instance, by providing a second chance to SBIR-participating businesses that failed to materialize their innovative ideas (policy stream);
- East Asian countries should leverage their high expectations of new technology in order to take bold actions regarding their SBIR programs, and update the programs by drawing out constructive dialogues between SBIR stakeholders (politics stream).

To digest the core of the U.S. SBIR program (including the Reauthorization) and to successfully import the institution and relevant knowledge to their own countries, East Asian countries should calibrate the U.S.'s aforementioned political differences. One way to do this is applying the Gar-

bage Can Model presented in the study. Taking these differences in problem, policy, and politics streams into account, for example, East Asia could allow more flexibility in funding, eligibility, and commercialization support but emphasize streamlining the award process and data and reporting when adopting the U.S. Program and updating their own SBIR policy directives.

One thing to note is that there are some limitations for each country in comparison to the U.S., because each country has different conditions of SMEs, participants and processes for small business. Furthermore, R&D programs of East Asian countries are much more diverse, complex, and demanding than the U.S. As a result, small businesses in East Asia are more likely to have difficulty in the application process and to suffer from bureaucratic formalities.

8. CONCLUDING REMARKS

The U.S. has achieved radical and disruptive policy innovations, one of which is the SBIR program. The U.S. keeps not only upgrading the program but also proposing other innovative ideas—e.g., SSIR program—to address social problems using SBIR program's entrepreneurial approach. East Asian countries, on the other hand, have had the experience of transforming themselves from original equipment manufacturer (OEM) to own design manufacturer (ODM) to own brand manufacturer (OBM) in the manufacturing arena. However, those successes have been made mainly through the hardware-focused and government-driven growth, retarding software and private sectors such as venture capital. With weak innovation foundations, East Asian countries are facing political challenges both internally and externally. For East Asian countries to dream of global leadership, they should carefully reflect their own political contexts in the imported innovation programs, to aggressively reform underlying components in three streams, such as values and norms, and to willingly take high, entrepreneurial risks instead of just imitating and trying to catch up.

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APPENDIX. GEM Key Indicators and Definitions

ENTREPRENEURIAL ACTIVITY	
Established Business Ownership Rate	Percentage of 18-64 population who are currently owner-manager of an established business, i.e., owning and managing a running business that has paid salaries, wages, or any other payments to the owners for more than 42 months
Improvement-Driven Opportunity Entrepreneurial Activity: Relative Prevalence	Percentage of those involved in TEA who (i) claim to be driven by opportunity as opposed to finding no other option for work; and (ii) who indicate the main driver for being involved in this opportunity is being independent or increasing their income, rather than just maintaining their income
Informal Investors Rate	Percentage of 18-64 population who have personally provided funds for a new business, started by someone else, in the past three years
Nascent Entrepreneurship Rate	Percentage of 18-64 population who are currently a nascent entrepreneur, i.e., actively involved in setting up a business they will own or co-own; this business has not paid salaries, wages, or any other payments to the owners for more than three months
Necessity-Driven Entrepreneurial Activity: Relative Prevalence	Percentage of those involved in TEA who are involved in entrepreneurship because they had no other option for work
New Business Ownership Rate	Percentage of 18-64 population who are currently a owner-manager of a new business, i.e., owning and managing a running business that has paid salaries, wages, or any other payments to the owners for more than three months, but not more than 42 months
Total early-stage Entrepreneurial Activity (TEA)	Percentage of 18-64 population who are either a nascent entrepreneur or owner-manager of a new business (as defined above)
Total early-stage Entrepreneurial Activity for Male Working Age Population	Percentage of male 18-64 population who are either a nascent entrepreneur or owner-manager of a new business (as defined above)
Total early-stage Entrepreneurial Activity for Female Working Age Population	Percentage of female 18-64 population who are either a nascent entrepreneur or owner-manager of a new business (as defined above)
ENTREPRENEURIAL ASPIRATIONS	
Growth Expectation early-stage Entrepreneurial Activity: Relative Prevalence	Percentage of TEA who expect to employ at least five employees five years from now
New Product early-stage Entrepreneurial Activity	Percentage of TEA who indicate that their product or service is new to at least some customers
International Orientation early-stage Entrepreneurial Activity	Percentage of TEA who indicate that at least 25% of the customers come from other countries
ENTREPRENEURIAL ASPIRATIONS	
Entrepreneurial Intention	Percentage of 18-64 population (individuals involved in any stage of entrepreneurial activity excluded) who intend to start a business within three years
Entrepreneurship as Desirable Career Choice	Percentage of 18-64 population who agree with the statement that in their country, most people consider starting a business as a desirable career choice
Fear of Failure Rate	Percentage of 18-64 population with positive perceived opportunities who indicate that fear of failure would prevent them from setting up a business
High Status Successful Entrepreneurship	Percentage of 18-64 population who agree with the statement that in their country, successful entrepreneurs receive high status
Know Startup Entrepreneur Rate	Percentage of 18-64 population who personally know someone who started a business in the past two years

Media Attention for Entrepreneurship	Percentage of 18-64 population who agree with the statement that in their country, you will often see stories in the public media about successful new businesses
Perceived Capabilities	Percentage of 18-64 population who believe to have the required skills and knowledge to start a business
Perceived Opportunities	Percentage of 18-64 who see good opportunities to start a firm in the area where they live