2024

National Economic Impacts from the National Nuclear Security Administration Nuclear Security Enterprise

National Nuclear Security Administration

Report by TechLink
techlinkcenter.org

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Contents

Executive Summary

This study provides a comprehensive assessment of the economic impacts stemming from 1,664 technology transfer agreements conducted by the Los Alamos National Laboratory (LANL); Lawrence Livermore National Laboratory (LLNL); Sandia National Laboratories (SNL); Kansas City National Security Campus; Missouri; Pantex Plant; Savannah River Site; Y-12 National Security Complex and the Nevada National Security Site (all plants and test sites are collectively referred to by Plants & Sites) all under the oversight of the National Nuclear Security Administration (NNSA) Nuclear Security Enterprise within the U.S. Department of Energy (DOE). Specifically, it examines 1,069 Cooperative Research and Development Agreements (CRADAs) and 595 license agreements (LAs) (which include patent license, copyright, hybrid, and bailment agreements) executed between 2000 and 2020.

The goal of this study is to quantify the contribution of these agreements to economic activity, job creation, and sustainability in the United States. The results, obtained through a combination of quantitative and qualitative assessments, offer a general overview and estimate the impact of technology transfer agreements on both the U.S. economy and national security.

The IMPLAN economic impact assessment model was used to estimate the economic impacts on the U.S. economy related to the sales of products and services enabled by these LAs and CRADAs. The results of this study likely understate the actual economic impacts due to various constraints such as multiple agreements with confidential outcomes, non-responding partners, the effects of inflation, deceased personnel, and other factors discussed in the report.

Partners with CRADAs and/or LAs were surveyed to evaluate which licenses and CRADAs from NNSA Laboratories and/or Plants & Sites led to:

1) New products and services that benefit the national economy.

2) Improvements to the nuclear weapons stockpile for the United States and our international allies.

3) Support for the NNSA missions.

Major Findings

Major findings from the study included the following:

$57 BILLION

in total sales of new products and services resulting from LAs and CRADAs

$23 BILLION

in sales of new products and services directly to the government

$156 BILLION

in total economic impact nationwide

$18 BILLION

in new tax revenues (federal, state, and local)

615,692 JOB YEARS SUPPORTED

with average yearly compensation of approximately $81,900

DOE, NNSA, and the Nuclear Security Enterprise

The Department of Energy (DOE), through its 17 national laboratories, spearheads innovation in the United States, excelling in invention disclosures and patents across various technology fields. NNSA is a semi-autonomous arm of the DOE that oversees three national laboratories as well as manufacturing and test sites. NNSA ensures the safety, security, and effectiveness of the nation's nuclear stockpile, addresses nonproliferation concerns, and manages naval nuclear propulsion. Additionally, it plays a crucial role in detecting and preventing weapons proliferation, safeguarding nuclear materials, supplying Navy propulsion fuel, and enhancing nuclear counterterrorism and emergency response capabilities.

The NNSA Nuclear Security Enterprise[1] oversees a comprehensive array of manufacturing, laboratory, and testing facilities to facilitate the research, development, production, dismantlement, and surveillance essential for sustaining the nuclear weapons stockpile.

- National Security Laboratories: Los Alamos National Laboratory (LANL) in Los Alamos, New Mexico; Lawrence Livermore National Laboratory (LLNL) in Livermore, California; and Sandia National Laboratories (SNL) in both Albuquerque, New Mexico, and Livermore, California.
- Manufacturing Plants and Sites: Kansas City National Security Campus in Kansas City, Missouri; Pantex Plant in Amarillo, Texas; Savannah River Site in Aiken, South Carolina; and Y-12 National Security Complex in Oak Ridge, Tennessee (referred to collectively as Plants & Sites).
- Test Site: Nevada National Security Site in Nye County, Nevada (included in above collective reference to Plants & Sites).

Every laboratory, facility, and site within the NNSA plays a pivotal role in upholding the safety, security, and efficacy of the U.S. nuclear deterrent.[2]

1 In the context of this report, NNSA Nuclear Security Enterprise will be referred to as NNSA.
2 Source: https://www.acq.osd.mil/ncbdp/nm/NMHB2020rev/docs/NMHB2020rev_Ch5.pdf

Research Team

TechLink, a federally funded technology transfer center at Montana State University,[3] collaborated with the Business Research Division (BRD) at the University of Colorado Boulder[4] to conduct this economic impact study. TechLink has been facilitating partnerships between Department of Defense (DoD) labs and U.S. industry since 1999, conducting numerous national economic impact studies. The BRD specializes in economic impact studies and custom research projects, aiding various organizations in making informed decisions. The study's principal authors were Joe Hutton, David Lynn, and Michelle Villarreal Zook from TechLink, along with Brian Lewandowski from the BRD. Other team members included Jenn Adams, Ray Friesenhahn, Cara Jorgensen, and Nic Richardson from TechLink.

Methodology

The research process involved three key phases:

1. **Data Gathering: From 2020 through 2024, the research team contacted external partners to collect data regarding CRADAs and LAs signed between 2000 and 2020.**
2. **Data Analysis: The evaluation team analyzed and combined all collected data. The anonymized data was run through the IMPLAN model by analysts at the BRD to estimate economic multipliers and total U.S. economic impacts resulting from the sales of new products and services derived from these agreements.**
3. **Final Report: Since 2020, the authors have compiled five reports based on five recent and earlier studies conducted including SNL, LLNL, LANL, and Plants & Sites.**

Data Gathering

The first study launched with an initial pilot study of limited SNL agreements in 2020, followed by studies with LLNL, LANL, a full review of SNL, and ultimately concluded with Plants & Sites in 2024, totaling five studies. During the five studies, the research team contacted partners from 2020 through 2024. While all CRADAs and license agreements, including patent licenses, bailment licenses, copyright licenses and hybrid (combined patent and copyright interests) licenses for the five studies were signed between the years 2000-2020, it is important to note that each of the five studies ended in a different year ranging from 2020 for Sandia (SNL) to 2024 for Plants & Sites. The research team captured data from partners covering a 25-year period, from 2000 through 2024.

Each agreement with sales results was assigned an industry specific 6-digit North American Industry Classification System (NAICS) code for economic impact analysis. This was an essential step for analysis of the overall economic impact. NAICS codes are used to assign industry sectors employed by the IMPLAN model. As the federal government's standard industry classification system, NAICS codes allow partners to be aggregated according to the specific activities they undertake. Researchers drew on discussions with respondents to identify the industry most applicable to the product or service sales resulting from the agreement.

3 For more information, see www.techlinkcenter.org
4 For more information, see www.colorado.edu/leeds/centers/business-research-division

TechLink submitted a final, anonymized dataset to the BRD at the University of Colorado Boulder, which included agreement identifiers, NAICS codes, total sales figures, and locations of research or manufacturing.

Noteworthy outcomes are highlighted in success stories within individual laboratory reports and are also available online.[5]

Data Analysis

The survey results offer an overview of total agreement outcomes and estimate their economic impact on the U.S. economy using IMPLAN through the BRD.

The IMPLAN model employed by the BRD allows users to estimate the economic contributions resulting from the gathered sales figures. More than 1,500 entities in academia, the private sector, and government use IMPLAN[6] to estimate economic impacts. Estimates can be specified by the state, county, or ZIP code level. IMPLAN draws on a mathematical input-output framework originally developed by Wassily Leontief, the 1973 Nobel laureate in economics, to study the flow of money through a regional economy. IMPLAN assumes fixed relationships between producers and their suppliers, based on demand, and that inter-industry relationships within a given region's economy largely determine how that economy responds to change. Increases in demand for a certain product or service causes a multiplier effect—a cascade of ripples through the economy. This increased demand affects the producer of the product, the producer's employees, the producer's suppliers, the suppliers' employees, and others, ultimately generating a total impact on the economy that significantly exceeds the initial change in demand.

For example, as a result of a CRADA with Sandia, a company develops an improved nuclear weapons detonation unit (NWDU) to foster more reliable nuclear weapons missile detonation. It subsequently manufactures these NWDUs and sells them to the NNSA and large prime contractors. The company needs to employ factory workers, who spend their earnings on groceries, housing, and other goods. It also must purchase machines, tools, components, and raw materials from other companies, which also employ workers who purchase goods. This ripple of activity extends through the economy.

In this illustration, we can categorize the economic effects into three key components:

1. **Direct Effects: These encompass the sales generated from the new NWDU, the employment opportunities created, and the payroll expended during the production phase.**
2. **Indirect Effects: These correspond to similar metrics stemming from purchases made across various industries for the components and raw materials required in NWDU production.**
3. **Induced Effects: These effects arise when employees utilize their wages to make purchases across a broad spectrum of the economy, further stimulating economic activity.**

The total economic impact results from the sum of these three components: direct effects, indirect effects, and induced effects.

5 For more information on reports and success stories, see https://techlinkcenter.org/economic-impact-reports
6 IMPLAN Group, LLC. IMPLAN [2021]. Huntersville, NC. www.IMPLAN.com

Upon receiving the sales data from TechLink, the BRD converted each NAICS code to its corresponding IMPLAN sector. With all the sales figures properly categorized, the model yielded an estimate of the direct, indirect, and induced effects resulting from the agreements. The overall purpose of this modeling exercise was to estimate the total economic contribution of these sales to the nation's economy, including total economic output, value added, employment, labor income, and tax revenues.

In the previous reports for SNL, LLNL, and LANL, different IMPLAN economy model years were utilized to estimate their economic impacts.

For this comprehensive report, all original sales data, including the data from the latest Plants & Sites study, were aggregated, and represent the total value of all domestic U.S. manufacturing and services reported by partners from all five studies. The survey did not ask when sales occurred; therefore, all dollars are assumed of equal value, despite occurring over the course of 25 years (2000-2024). For IMPLAN modeling, the analysis used 2022 as the base year, with outputs in 2023 dollars and basing impact estimates on the economy of 2022.

2022 was selected as the base year due to being the most recent IMPLAN model year available and to minimize skewing the estimate with the unusual economic landscape induced by the SARS-CoV-2 pandemic. This approach ensures consistency with previous national-focused reports. Using 2022 as the reference year represents a conservative approach as it ignores the higher value of earlier sales figures (the majority of sales occurred prior to 2020) due to inflation (for example, $100 in 2000 had the same purchasing power as $167 in 2022).

Survey Results

Did your company develop any new or improved products or services based on this CRADA or license?

As displayed in Table 1 below, 25% of all agreements were reported to have generated new or improved products or services at the time of the survey. Regarding these agreements, CRADAs and licenses constituted approximately 59% and 41%, respectively. Twelve percent of all agreements were reported to be currently under development. Of these agreements still under development, CRADAs and licenses comprised approximately 83% and 17% respectively, of the total.

Table 1: New or improved products or services resulting from T2 agreements

Response	Total	CRADAs	Licenses
No	56%	62%	38%
Yes	25%	59%	41%
Tech Still in Development	12%	83%	17%
Tech Abandoned	6%	69%	31%
Unknown*	1%	79%	21%

Note: Totals may not sum to 100% due to rounding.
*Respondents unable to provide an answer due to limited to non-existent availability of historical company records, corporate restructuring/dissolutions, deceased personnel.

Perhaps most important to note for Table 1 is that CRADAs accounted for approximately 64% of total agreements in the study but only 59% of all yes responses while LAs accounted for approximately 36% respectively of the total number agreements but 41% of all yes responses. Therefore, due to the disproportionate number of CRADAs and LAs, Table 2 (below) portrays the percentages of CRADAs and LAs relative to their respective totals.

Table 2: New or improved products or services resulting from T2 agreements relative to their respective totals

Response	CRADAs	Licenses
No	54%	60%
Yes	23%	28%
Tech Still in Development	15%	6%
Tech Abandoned	6%	5%
Unknown*	1%	1%

Note: Totals may not sum to 100% due to rounding.
*Respondents unable to provide an answer due to limited to non-existent availability of historical company records, corporate restructuring/dissolutions, deceased personnel.

Fifty-four percent of all CRADAs were reported to have generated no new or improved products or services while 60% of all LAs reported the same; however, 28% of all LAs were reported to have generated new or improved products or services while 23% of all CRADAs reported the same. While LAs accounted for only 36% of the total number of agreements, they accounted for 28%--or five percentage points more than CRADAs--of all yes responses.

Responses regarding ongoing development of the technology were noticeably different as approximately 15% of CRADAs reported the work was ongoing, while only 6% of LAs reported the same. This represents an opportunity for further investigation to determine if there are any reasons as to what is causing this difference. One possible explanation may lie in the difference in purpose or focus of a CRADA versus a license agreement.

It should be noted that a "Yes" answer to this question in Table 2 does not necessarily mean these technologies had been commercialized. Occasionally products resulting from these partnerships are simply turned over to a respective laboratory, plant, or site as a developing technology or prototype. Alternatively, a "No" answer does not necessarily mean that the T2 agreement did not result in economic impacts.

How many employees did your company have at the time that this CRADA or license was established?

How many employees does your company currently employ?

The purpose of these two questions was to capture the change in company size based on employee count from the time the agreement was established to the current study year to determine if T2 agreements contributed to company growth. Table 3 below displays the aggregated survey responses.

Table 3: Partner Size by employee count

Partner Size Category	At Time of Agreement	At Time of Survey
Large (500+)	46%	49%
Medium (100-499)	8%	8%
Small (10-99)	21%	20%
Very Small (1-9)	21%	17%
Unknown*	4%	6%

Note: Totals may not sum to 100% due to rounding.
*Includes non-responsive companies, companies that refused, situations where no company contact was available, uncontacted companies, and companies that were unable to locate records for the agreement.

In cases where the subject technology was acquired by a different entity, the size at the time of survey indicates the size of the current organization overseeing the technology portfolio. Forty-six percent of all partner responses reported their size as being large at the time the agreement was established while 49% of respondents reported the same at the time of the survey, representing a three-percentage point increase overall. The medium partner sized category remained constant at 8% while the small category posted a one-percent decline to 20%. The very small partner size category declined by four-percentage points while the unknown category increased two-percentage points to 6%. These were marked unknown at the time of the survey, due to the partner being uncontacted, out of business, or acquired by a larger organization with no interest in the specified T2 technology.

The changes within each partner category could perhaps be due to a constantly changing mixture of causes including (but not limited to); partners growing organically, merging with or acquiring other organizations, being acquired by a larger organization, downsizing due to changing market conditions/business strategies and dissolutions as a result of retirement or lack of profitability.

Table 4 below displays the aggregate results of all responses to the survey question above regarding new products/services question by partner size.

Table 4: New or improved products or services resulting from T2 agreements by Partner Size

Partner Size*	Yes	No	Tech Still in Development	Tech Abandoned	Unknown**
Large (500+)	40%	50%	51%	38%	50%
Medium (100-499)	7%	11%	4%	6%	7%
Small (10-99)	25%	20%	21%	24%	7%
Very Small (1-9)	27%	19%	25%	31%	7%
Unknown**	0%	0%	0%	0%	29%
Response Total for Review	25%	56%	12%	6%	1%

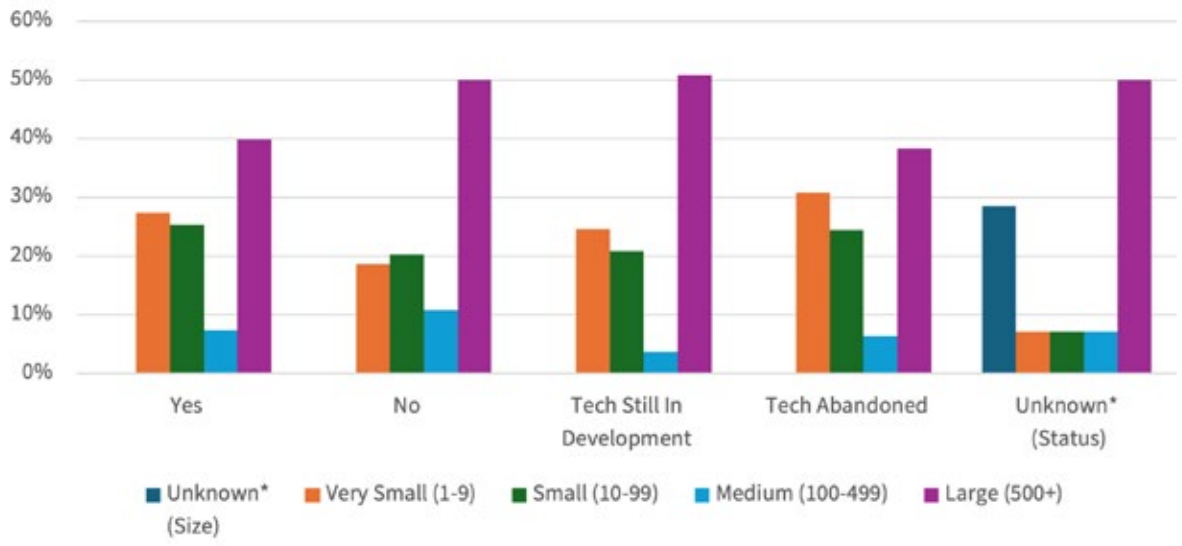
Note: Totals may not sum to 100% due to rounding.
*Partner size at time the agreement was established.
**Respondents were unable to provide an answer due to corporate or organizational structural changes, deceased personnel, and limited to non-existent availability of historical company records.

Approximately 25% of all responses collected indicated "Yes" that there was a new or improved product or service developed from the agreement while 56% of all responses collected indicated "No." Large partners accounted for the single largest percentage of responses in each category. Given that large partners accounted for 46% of all agreements included in the study, which is more than double the size of the next highest partner size category (small), it could be anticipated that this category would post the highest frequency in at least one or more of the categories.

For all "Yes" responses, large partners accounted for approximately 40%, with very small partners following at 27%, and small partners closely behind at 25%. Combined, very small and small partners accounted for 52% of all yes responses yet only accounted for 42% of all agreements included in the study. Very small and small companies accounted for approximately 39% of all "No" responses versus large partners accounting for 50%.

Utilizing the data from Table 4, Figure 1 below displays each response category with partner size composition represented by the colored columns.

Figure 1: New or improved products or services resulting from T2 agreements by Partner Size



*Respondents were unable to provide an answer due to corporate or organizational structural changes, deceased personnel, and limited to non-existent availability of historical company records.

Large partners, represented by the purple columns, dominate each response category. Again, due to large partners accounting for the single highest proportion of agreements in the study, at 46%, this is perhaps not a surprise. Very small and small, represented by the orange and green columns respectively, maintain a similar percentage to one another in every category. Combined, these two partner size categories account for 42% of all agreements included in the study.

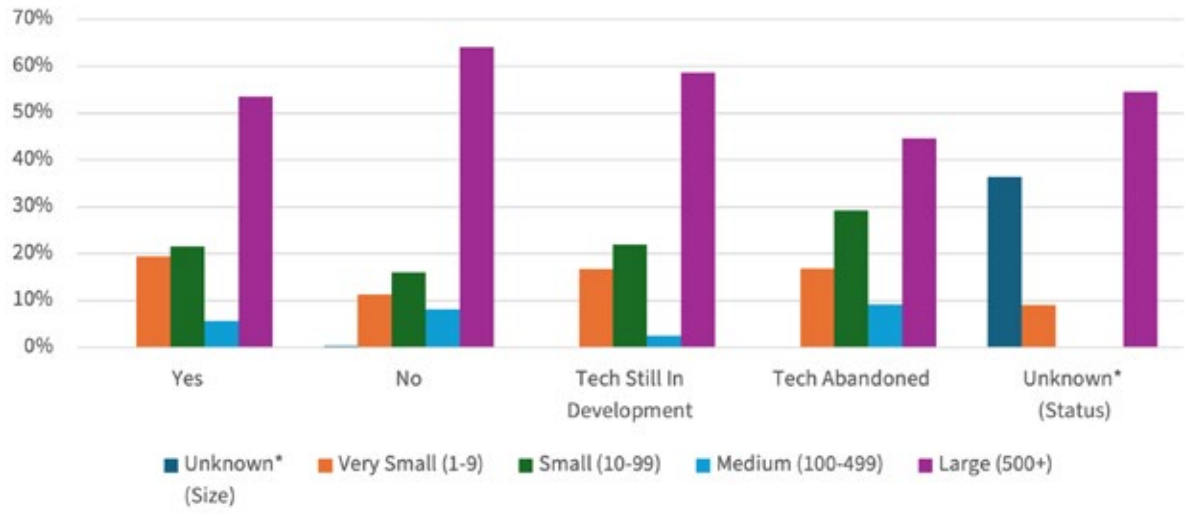
Table 5: CRADAs and LAs by Partner Size

Partner Size	CRADAs	Licenses	Total
Large (500+)	59%	24%	47%
Medium (100-499)	7%	13%	9%
Small (10-99)	19%	27%	22%
Very Small (1-9)	14%	36%	22%
Unknown*	1%	0%	0%

Note: Totals may not sum to 100% due to rounding.
*Respondents were unable to provide an answer due to corporate or organizational structural changes, deceased personnel, and limited to non-existent availability of historical company records.

In Table 5 above, the large partner category accounted for approximately 59% of all CRADA agreements, 24% of all LAs, and 47% of all agreements. Small and very small partners combined accounted for 33% of all CRADAS, 63% of all LAs, and 44% of all agreements.

Figure 2: New or improved products or services resulting from CRADA agreements by Partner Size

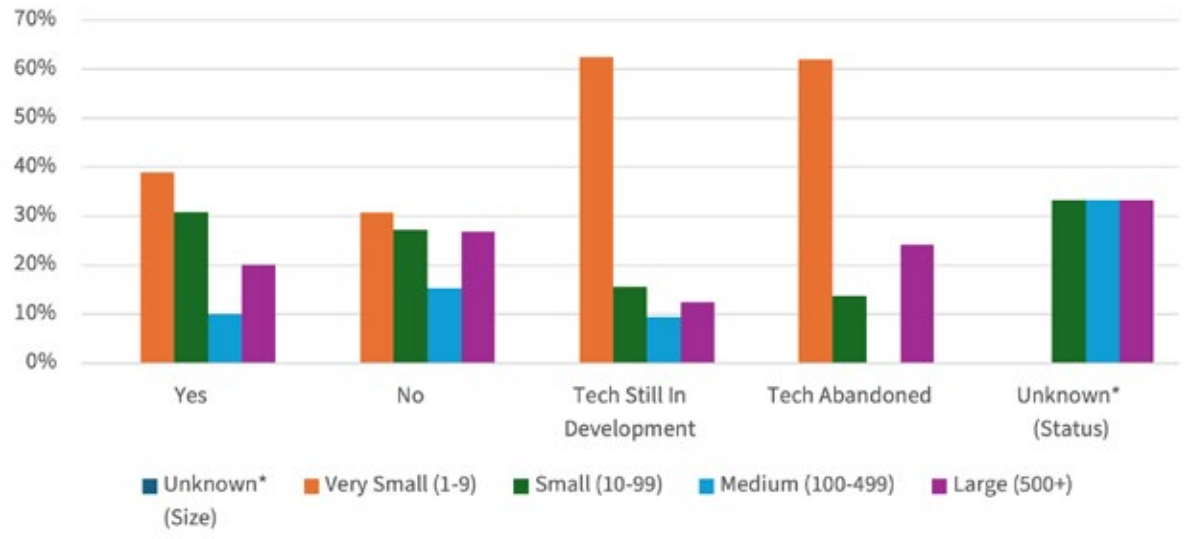


*Respondents were unable to provide an answer due to corporate or organizational structural changes, deceased personnel, and limited to non-existent availability of historical company records.

Figure 2 above utilizes the data from Figure 1 but displays the survey results for only CRADA agreements. Large partners account for the single largest percentage in each response category. Important to note that large partners accounted for 59% of all CRADA agreements per table 5. Very small and small partners display similar percentages in every category except in the "Tech Abandoned" category, where small partners captured 29% of the responses versus very small partners posting 17%.

Figure 3 below utilizes the data from Figure 1 but displays the survey results for only LAs.

Figure 3. New or improved products or services resulting from LAs by Partner Size



*Respondents were unable to provide an answer due to corporate or organizational structural changes, deceased personnel, and limited to non-existent availability of historical company records.

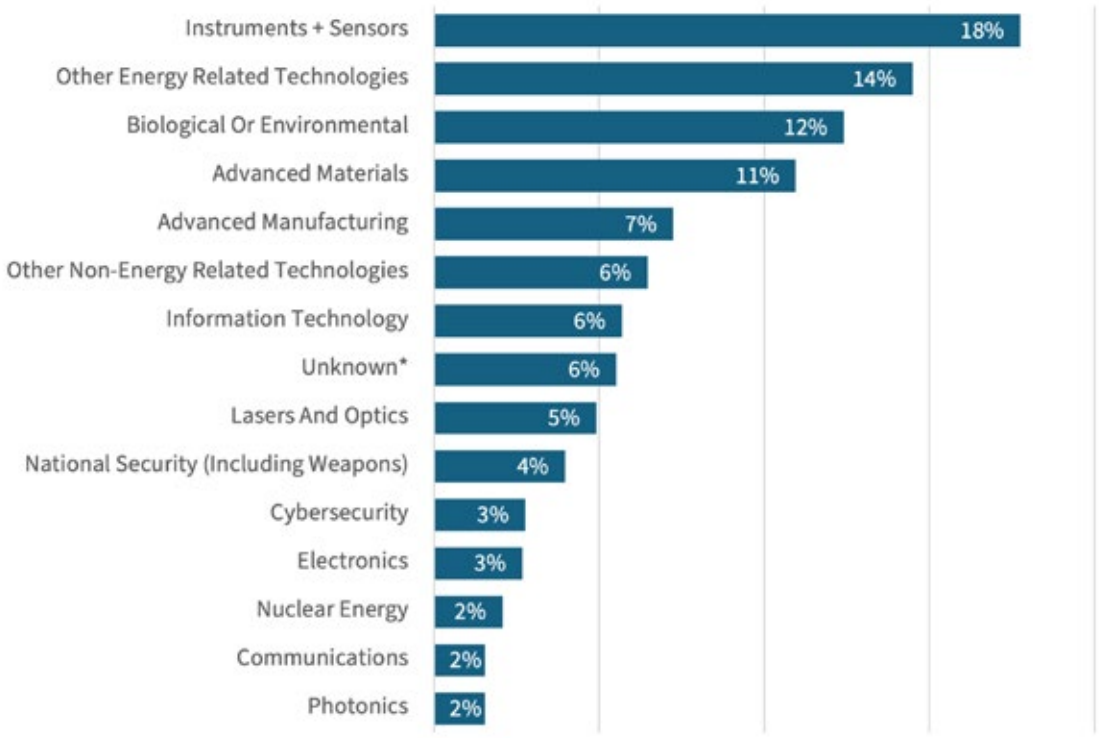
Aside from the "Unknown" category, very small partners possessed the highest single percentage in every other response category. Very small partners accounted for 36% of all license agreements surveyed--or nine percentage points higher than the next closest partner size (Small). Interestingly, although very small and small partners account for similar percentages in the "Yes" and "No" category responses, the categories resulted in widely different percentages in the "Tech Still In Development" and "Tech Abandoned" category responses.

One possible hypothesis may be that very small partners work on fewer projects simultaneously due to having less employees versus small partners. Therefore, very small partners' timelines for each project could possibly be longer in duration. Alternatively, perhaps there is a difference in the types of technologies being pursued which require different development and/or implementation phases and timelines due to testing requirements, regulatory hurdles, material procurement, etc. This could potentially represent an avenue for further study in the near future to examine whether there are any meaningful reason(s) for these differences.

As a result of this agreement, how would you categorize the technology from an IP perspective?

Figure 4 below summarizes all reported responses to the above question regarding categorizing the type of technologies resulting from these T2 agreements. Companies could only choose one technology category from a list of 15 categories that best fit the technology in their agreement. Responses to this question were gathered from all laboratories, plants and sites with the exception of the pilot SNL, which did not include this question at the time. This question would be added to the general survey after the pilot SNL review concluded.

Figure 4: Technologies resulting from T2 agreements



Note: Total may not sum to 100% due to rounding.
*Respondents were unable or unwilling to choose one of the offered categories due to the principal investigator/project participant being deceased and limited to non-existent availability of historical company records.

As shown in Figure 4, Instruments and Sensors category led the way for the most frequently reported category with approximately 18% of all responses, followed by Other Energy Related Technologies (14%), Biological or Environmental (12%), and Advanced Materials (11%). These four categories accounted for approximately 55% of all technology category responses, with the remaining 11 categories combined accounted for the residual 45% of all responses. Unknown responses (6%) included agreements where respondents were unable or unwilling to choose one of the offered categories.

Was your company a start-up company specifically created for this CRADA or LA?

Figure 5: Percentage breakdown of all responses aggregated from start-up company question above

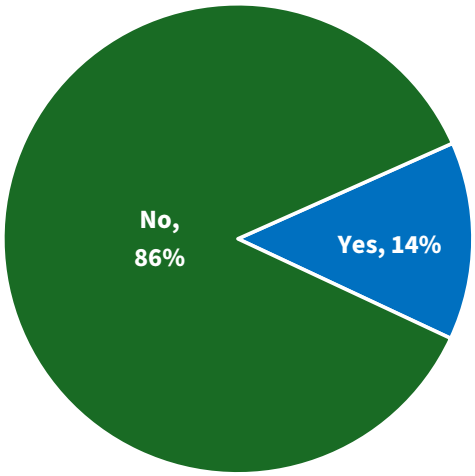
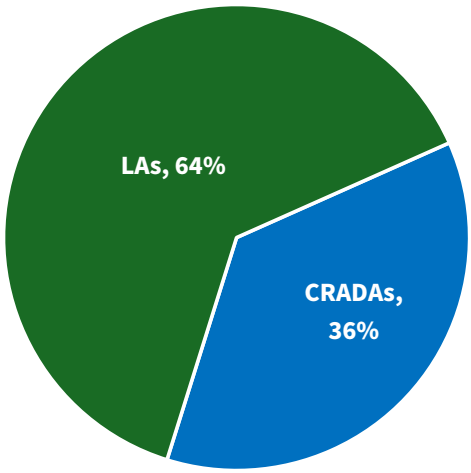


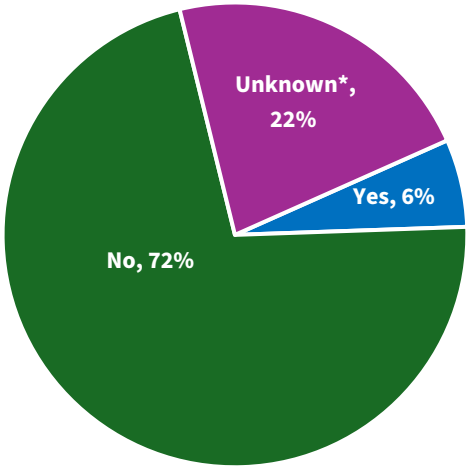
Figure 6: Composition of all "Yes" responses to the start-up company question above by agreement type



Per Figure 6, LAs accounted for approximately 64% of all reported start-up companies but accounted for only 36% of the total number of agreements included in the study. CRADA agreements accounted for 36% of start-up companies while accounting for 64% of the total number of agreements included in the study.

Did this agreement result in any products or services that are being used, or have been used by DOE/NNSA, the U.S. Military, or any other national security agency?

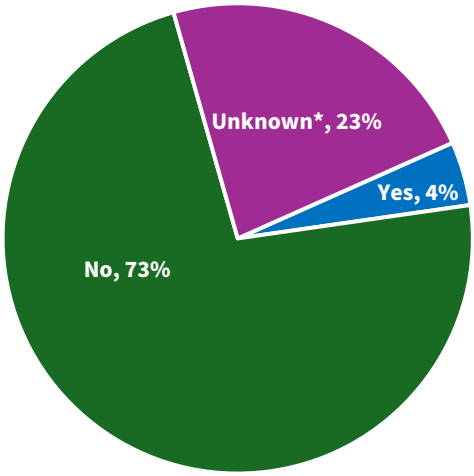
Figure 7: The percentage breakdown of all responses aggregated from DOE/NNSA question above



*Respondents were unable or unwilling to choose one of the offered categories due to the principal investigator/project participant being deceased and limited to non-existent availability of historical company records.

Did this agreement contribute to non-proliferation including reducing the threat of nuclear or radiological terrorism, nuclear material management, security, removal, or disposal?

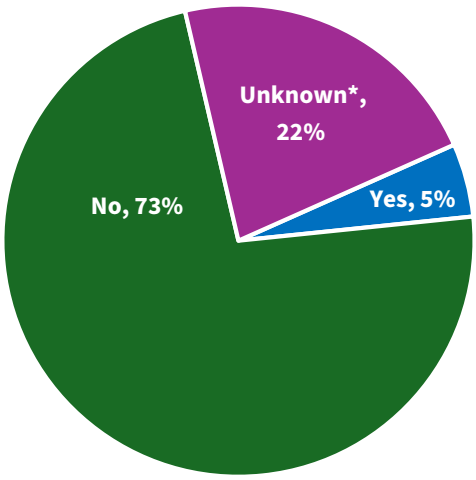
Figure 8: The percentage breakdown of all responses aggregated from non-proliferation question above



*Respondents were unable or unwilling to choose one of the offered categories due to the principal investigator/project participant being deceased and limited to non-existent availability of historical company records.

Did this agreement technology or aspects of the technology result in any commercial off the shelf (COTS) products being purchased or used by DOE/NNSA, the U.S. military, or any other national security agency?

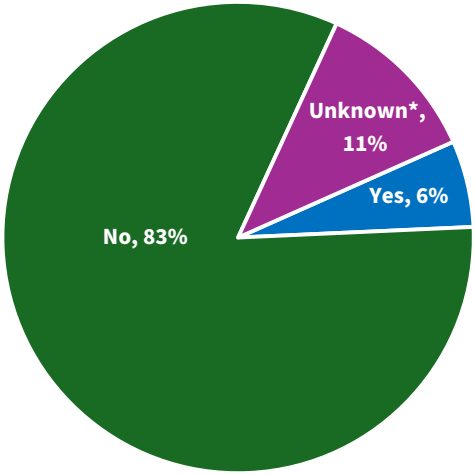
Figure 9: The percentage breakdown of all responses aggregated from the COTS question above



*Respondents were unable or unwilling to choose one of the offered categories due to the principal investigator/project participant being deceased and limited to non-existent availability of historical company records.

In your opinion, throughout the life cycle of this technology to date, has the partnership provided additional cost savings or costs avoided to the U.S. Government?

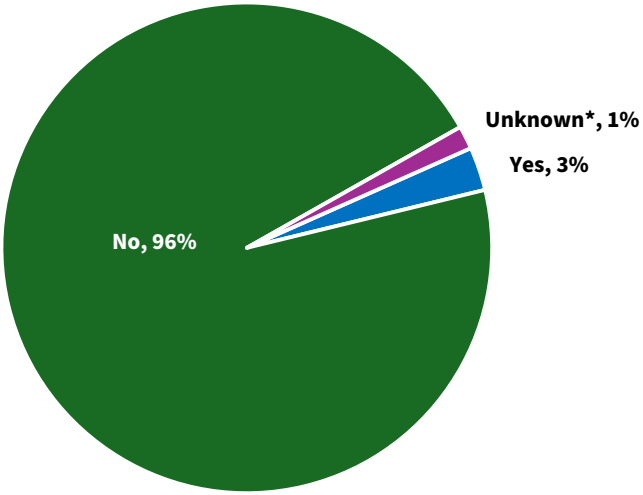
Figure 10: The percentage breakdown of all responses aggregated from the cost savings/ avoided question above



*Respondents were unable or unwilling to choose one of the offered categories due to the principal investigator/project participant being deceased and limited to non-existent availability of historical company records.

Did your company license or sub-license any of the technology developed from this agreement?

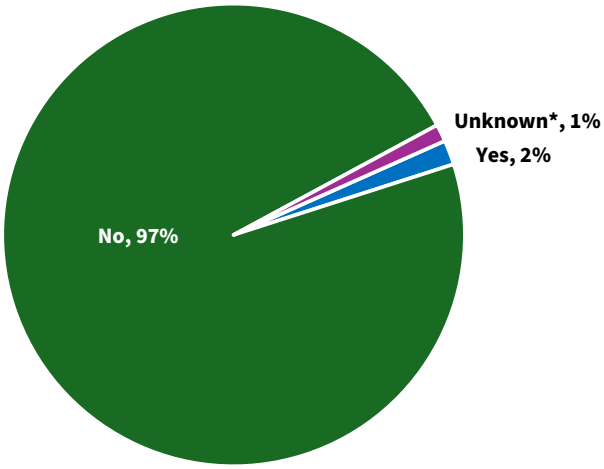
Figure 11: The percentage breakdown of all responses aggregated from the licensing question above



*Respondents were unable or unwilling to choose one of the offered categories due to the principal investigator/project participant being deceased and limited to non-existent availability of historical company records.

Did your company create a spin-off company to commercialize any technology developed under this CRADA or LA?

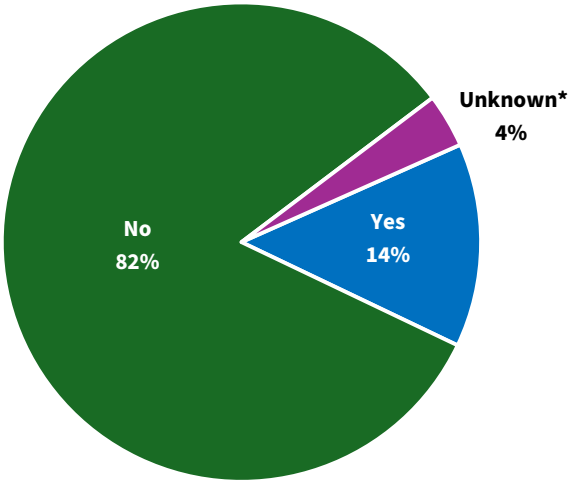
Figure 12: The percentage breakdown of all responses aggregated from the spin-off question above



*Respondents were unable or unwilling to choose one of the offered categories due to the principal investigator/project participant being deceased and limited to non-existent availability of historical company records.

Did your company receive any outside investment funding (angel, venture capital, or state funding) due to this agreement?

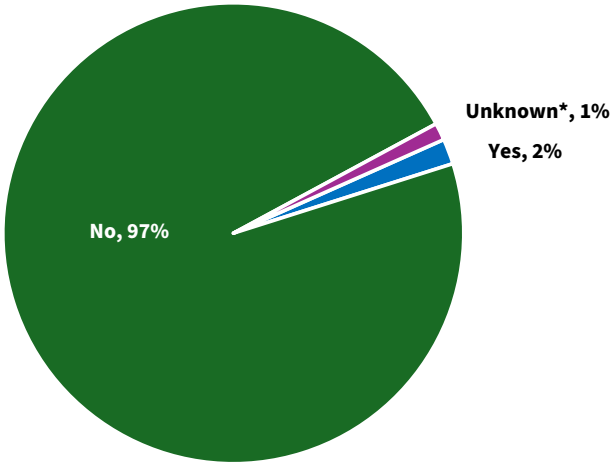
Figure 13: The percentage breakdown of all responses aggregated from the outside investment question above



*Respondents were unable or unwilling to choose one of the offered categories due to the principal investigator/project participant being deceased and limited to non-existent availability of historical company records.

Was the company acquired due to this agreement?

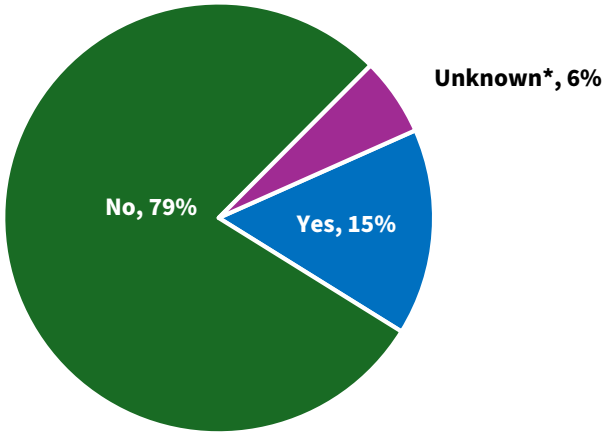
Figure 14: The percentage breakdown of all responses aggregated from the acquisition question above



*Respondents were unable or unwilling to choose one of the offered categories due to the principal investigator/project participant being deceased and limited to non-existent availability of historical company records.

Have there been any other uses or benefits from this technology focused on non-stockpile related national defense outcomes (such as medical benefits, cyber, transportation, etc.)?

Figure 15: The percentage breakdown of all responses aggregated from the non-stockpile question above[7]

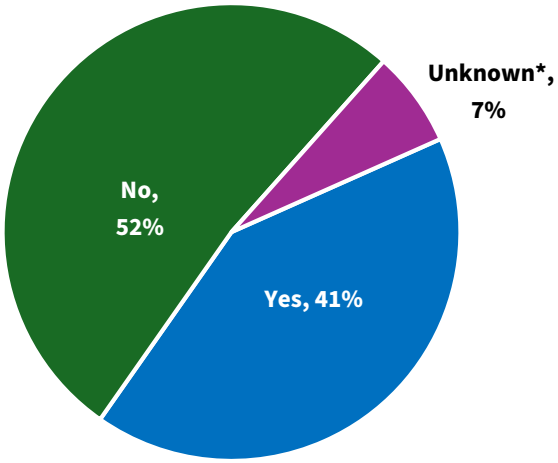


*Respondents were unable or unwilling to choose one of the offered categories due to the principal investigator/project participant being deceased and limited to non-existent availability of historical company records.

7 Responses to this question were gathered from all laboratories, plants and sites except for the pilot SNL, which did not include this question at the time. This question would be added to the general survey after the pilot SNL review concluded.

Have there been any benefits to your company from this agreement besides sales of new technology or other economic results?

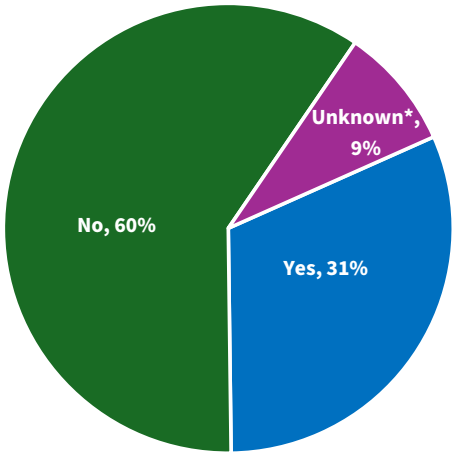
Figure 16: The percentage breakdown of all responses aggregated from the benefits to your company question above



*Respondents were unable or unwilling to choose one of the offered categories due to the principal investigator/project participant being deceased and limited to non-existent availability of historical company records.

Are you aware of any specific benefits to the lab/NNSA/DOE from this agreement?

Figure 17: The percentage breakdown of all responses aggregated from the benefits the lab/NNSA/DOE question above



*Respondents were unable or unwilling to choose one of the offered categories due to the principal investigator/project participant being deceased and limited to non-existent availability of historical company records.

IMPLAN Economic Impact Analysis

The survey's sales data are used to estimate the economic impact of NNSA Labs T2 partnerships on the U.S. economy.[8]

The analysis assumes that these sales represent domestic production, benefiting various industries and households by spending on materials and labor. To ensure accuracy, sales related to international manufacturing were excluded. Adjustments were made to consider only domestic sales, resulting in an estimated direct impact of approximately $57 billion on the U.S. economy. The adjusted sales data were sent to the BRD at the University of Colorado Boulder, where the IMPLAN model was used to estimate economic activity. The aggregated results from the IMPLAN model are shown in Table 6, and further discussions on outcomes are provided.

As no individual lab data or analysis is provided in this comprehensive report, please reference prior completed individual lab reports for more detail.[9]

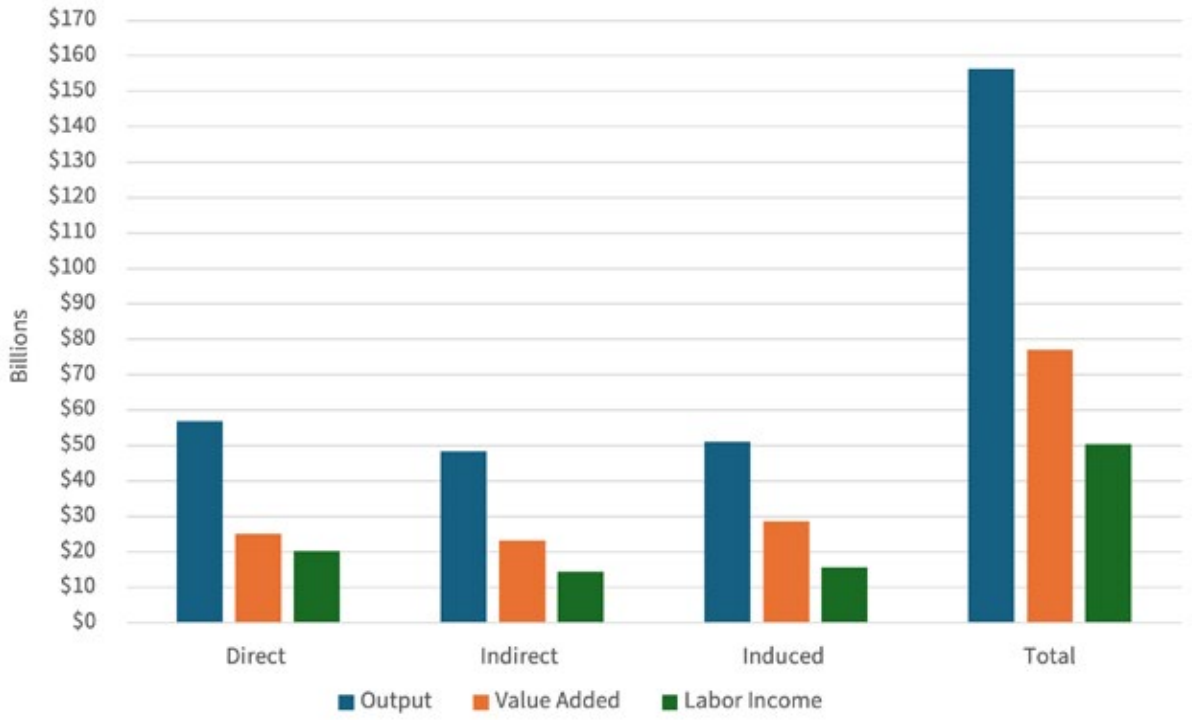
Table 6: IMPLAN estimates of economic impacts from the T2 agreements in 2023 dollars.

Impact	Output ($ Millions)	Value Added ($ Millions)	Employement (Job Years)	Labor Outcome ($ Millions)
Direct	$56,929	$25,105	193,326	$20,293
Indirect	$48,457	$23,196	180,981	$14,321
Induced	$50,989	$28,756	241,385	$15,783
Total	$156,375	$77,057	615,692	$50,397

Drawing from Table 6 above, Figure 18 below provides a visual display of each impacts category with colored columns resprenenting associated outputs, valued added, and labor income data.

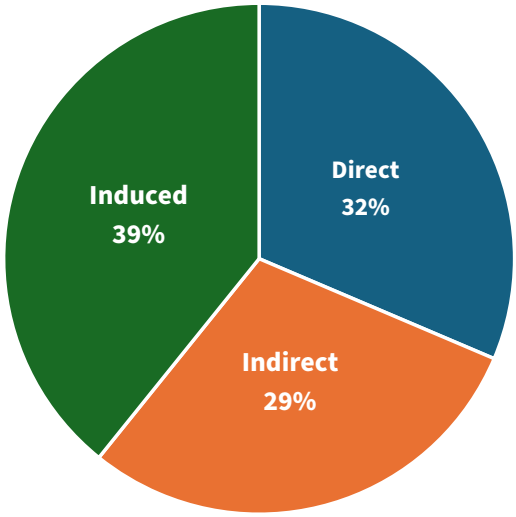
8 In the context of this report, T2 refers to Technology Transfer
9 For more information on reports and success stories, see https://techlinkcenter.org/economic-impact-reports

Figure 18: IMPLAN estimates of impacts on the U.S. economy



Drawing from Table 6, Figure 19 below provides the composition of estimated employment results by each impact category.

Figure 19: IMPLAN Employment Estimate, total job years 615,692



Total Economic Impact (Output):
$156 BILLION

Output is the overall economic impact, including all purchases made by both intermediate and final consumers. It is the total value of direct, indirect, and induced sales combined. Output is a commonly referenced value in economic impact studies.

Value Added:
$77 BILLION

Value added is the extra value created by a company through its production process. It is calculated as the difference between what a company sells its products for, and the cost of the materials used to make them, excluding labor costs. This concept acknowledges that companies add value to raw materials by turning them into finished products. In IMPLAN, value added is estimated as total sales (with inventory adjustments) minus the cost of goods and services bought to make those products.

Employment:
615,692 JOB YEARS SUPPORTED

According to the IMPLAN model, the sales generated by agreements and their economy-wide ripple effects supported approximately 615,692 job years. This includes 193,326 job years directly from the sales of new products and services, 180,981 indirectly, and 241,385 induced job years. Each job year is defined as one job supported for one year.

Labor Income:
$50 BILLION

Labor income includes wages, salaries, and benefits for employees, as well as income received by self-employed individuals. The national IMPLAN model estimated that the total economy-wide labor income resulting from the agreements was over $50 billion. The average compensation from the 615,692 jobs supported through these agreements was approximately $81,900.

Tax Revenues:
$18 BILLION

Tax revenues were calculated for the $56.9 billion in sales and their economy-wide indirect and induced effects. These taxes included Social Security, Medicare, personal income taxes, motor vehicle licenses, property taxes, corporate profits taxes, dividends, and indirect business taxes like excise and property taxes. In total, federal, state, and local governments collected an estimated $18 billion in taxes. This total is comprised of $12 billion in federal taxes and $6 billion in state and local taxes. On average, for every dollar of direct sales generated from these agreements, government entities collected $0.32 in taxes due to total estimated impacts.

Summary

This study examines the impacts of a subset of technology transfer partnerships between the NNSA Nuclear Security Enterprise and external parties, known as CRADAs and LAs. Its main focus is to gauge the economic impact of these agreements on the national economy. Findings suggest that these partnerships may benefit the U.S. economy and contribute to advancements in science and nuclear security. Through a thorough survey, the study estimates that these agreements have generated $57 billion in sales. Economic ripple effects were assessed using the IMPLAN model, revealing broader impacts on economic output, employment, income, and tax revenue.

Over the span of 25 years (2000-2024), the total economic output amounted to $156 billion, with $77 billion in value added, signifying new wealth creation. This led to the support of 615,692 job years with an average compensation of $81,900 and a total labor income of $50 billion. The $57 billion in sales, along with its broader economic impacts, generated approximately $18 billion in total tax revenue, comprised of $12 billion in federal taxes and roughly $6 billion in state and local taxes.

Estimated Total Economy-Wide Output:

$156 BILLION

over 25 years (2000-2024)

APPENDIX

Even though NNSA CRADA/LA partners were only located in a relatively small number of states, economic impacts are typically spread across all U.S. states, due to the indirect and induced effects of the manufacturing and sales of new products.

State	Employment	Labor Income	Value Added	Total Economic Impact
Alabama	11,463	797,570,268	1,134,646,321	3,194,216,931
Alaska	729	52,910,708	68,545,200	121,019,329
Arizona	43,720	3,388,588,267	4,213,982,768	7,162,326,690
Arkansas	971	62,233,847	116,026,204	288,408,870
California	57,957	5,722,512,319	8,311,619,639	14,245,789,207
Colorado	2,343	174,245,282	276,515,029	540,371,267
Connecticut	4,890	560,390,437	1,007,573,055	1,950,568,685
Delaware	713	47,176,603	119,385,232	212,898,508
District of Columbia	883	109,375,840	155,037,379	239,653,111
Florida	77,620	5,365,552,772	7,039,044,686	13,208,324,903
Georgia	5,462	370,699,333	633,097,739	1,379,700,254
Hawaii	154	9,629,582	17,814,307	33,349,207
Idaho	1,549	70,155,553	116,319,125	226,057,092
Illinois	8,163	718,696,947	1,356,081,423	3,158,548,668
Indiana	3,806	265,734,212	491,359,763	1,226,437,930
Iowa	848	58,164,102	111,733,553	288,101,263
Kansas	9,404	699,992,142	1,006,600,821	2,827,018,794
Kentucky	3,518	194,317,587	341,564,571	799,038,590
Louisiana	2,037	165,397,283	409,342,403	1,213,399,032

State	Employment	Labor Income	Value Added	Total Economic Impact
Maine	376	27,230,782	44,177,791	100,158,765
Maryland	54,335	6,424,840,416	12,554,948,877	19,932,296,521
Massachusetts	5,275	548,853,500	840,047,438	1,653,358,996
Michigan	4,915	342,528,619	557,857,478	1,287,568,398
Minnesota	3,567	337,763,042	543,579,991	1,216,310,171
Mississippi	860	47,070,436	91,441,566	291,614,950
Missouri	2,307	152,316,998	255,724,327	601,335,845
Montana	744	21,322,790	38,517,605	86,407,782
Nebraska	571	40,023,724	84,070,858	185,346,320
Nevada	17,161	1,176,480,599	1,351,378,631	2,362,729,836
New Hampshire	506	41,968,080	60,590,861	136,434,040
New Jersey	4,204	356,324,385	572,920,179	1,089,081,154
New Mexico	8,880	753,629,132	1,204,937,798	2,849,054,008
New York	18,375	1,755,870,764	2,855,100,968	5,077,344,014
North Carolina	14,417	1,040,503,480	1,594,051,064	4,092,185,808
North Dakota	210	14,209,361	32,730,029	68,562,342
Ohio	118,623	9,043,907,105	13,838,515,150	34,733,018,996
Oklahoma	9,736	662,639,236	973,136,699	2,811,575,834
Oregon	6,297	424,942,469	678,086,956	1,268,397,859
Pennsylvania	10,685	796,497,345	1,206,801,539	2,508,051,927
Rhode Island	282	20,297,741	31,175,625	71,057,330
South Carolina	20,183	1,401,590,590	1,668,453,323	3,151,474,734

State	Employment	Labor Income	Value Added	Total Economic Impact
South Dakota	374	20,698,799	34,355,803	78,336,117
Tennessee	4,244	326,786,377	542,695,978	1,309,707,590
Texas	20,481	1,584,931,930	2,812,289,666	6,163,567,160
Utah	23,333	2,074,181,438	2,384,352,379	3,974,995,092
Vermont	2,572	174,607,264	190,898,169	349,452,340
Virginia	15,033	1,144,521,546	1,727,771,355	4,014,703,399
Washington	5,706	491,735,270	816,466,493	1,344,108,182
West Virginia	1,560	78,964,463	156,118,324	356,600,777
Wisconsin	3,203	218,724,652	350,261,695	820,183,723
Wyoming	447	18,758,883	36,745,256	75,240,403
Total	**615,692**	**50,398,064,298**	**77,056,489,088**	**156,375,488,741**

Data analysis conducted by TechLink, in collaboration with Business Research Division (BRD) at the Leeds School of Business, University of Colorado Boulder.

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