

Economic Impact of Commercialization on the State and National Economy

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EXECUTIVE SUMMARY

Research universities provide both foundational basic research and the potential for translating research into commercialized products. Sometimes new technologies lead to the formation of new companies.

Venture Partners at CU Boulder research innovations into new commercial ventures, including management of intellectual property created on the Boulder, Colorado Springs, and Denver campuses.

Venture Partners at CU Boulder provided data on 367 licensee records representing 315 unique agreements between fiscal year 2017-18 through fiscal year 2021-22. A total of 281 agreements noted paid license revenue to CU, 46 recorded follow-on sales, and 57 were CU startups that recorded a capital round. Awards spanned 36 states and 26 countries. Domestic agreements totaled 263, or 83.5% of the agreements, 91.4% of the license revenue to CU, 99.2% of the inferred product sales, and 99.9% of the start-up capital raised.

From fiscal year 2018 through fiscal year 2022, Venture Partners at CU Boulder recorded:

- \$20.1 million in licensing revenue to the University of Colorado Boulder
- \$1.1 billion in inferred sales by licensees related to CU technology
- \$3.0 billion in capital funding for startup companies commercializing CU Boulder technology
- \$45.4 million in commercialization-specific grants to CU Boulder.

The economic contribution of commercialization activities identifies upstream and downstream economic activity, spanning research and development at the university to commercialization by private enterprises.¹ Removing overlapping funding from follow-on sales and license revenue, and from commercialization grants and license revenue, results in mutually exclusive Venture Partners-related economic activity. The estimated \$4 billion in domestic Venture Partners-related activity resulted in an economic impact on the national economy totaling \$8 billion from fiscal year 2018 through fiscal year 2022. This level of activity supported an estimated 39,000 job years over the five-year period (or an average of 7,8000 per year), paying an estimated \$3.1 billion in labor income. Value added, which removes the estimate of intermediate inputs, totaled \$4.7 billion.

Direct Effect	17,937	3,587	\$1.7	\$2.4	\$4.0
Indirect Effect	8,099	1,620	\$0.6	\$0.9	\$1.7
Induced Effect	13,101	2,620	\$0.7	\$1.4	\$2.3
Total Effect	39,137	7,827	\$3.1	\$4.7	\$8.0

Much of the activity was recorded in Colorado, with \$2.8 billion in tech transfer-related activity, leading

¹ Given the analysis of on-campus activity and external private-sector sales, the economic impact of technology transfer activities should not be combined or compared with overall University economic contributions.

PROJECT PURPOSE

Research universities provide both foundational basic research and the potential for translation that becomes enabling technology in commercialized products. Sometimes the new technologies lead to the formation of new companies. The purpose of this project was to quantify the economic impacts of commercialization from Venture Partners at CU Boulder (Venture Partners, formerly known as the technology transfer office) on the state and national economy.

DEFINITIONS

Gross Domestic Product (GDP): A measure of economic activity, GDP is the total value added by resident producers of final goods and services.

Gross Output (Output): The total value of production is gross output. Unlike GDP, gross output includes intermediate goods and services.

Value Added: The contribution of an industry or region to total GDP, value added equals gross output, net of intermediate input costs.

Labor Income: Total compensation of employees (wages and benefits) and sole proprietors (profits).

Employment Job Year: Equates to one job in one year.

Direct Impact: Initial economic activity (e.g., sales, expenditures, employment, production, etc.) by a company or industry.

Indirect Impact: The upstream (backward) economic activity impacted by purchases along a company or industry supply chain.

Induced Impact: Economic activity derived from workers spending their earnings on goods and services in the economy.

GENERAL METHODOLOGY

The Business Research Division conducted a study of the economic impacts of 315 unique tech transfer agreements

was classified as Professional, Scientific, and Technical Services (541) for the Scientific Research and Development Services. Follow-on sales and capital funding were classified based on the NAICS corresponding to each licensee. Follow-on sales and funding were classified into eight industries based on their operating function:

- 31-33 Manufacturing
- 42 Wholesale Trade
- 51 Information
- 54 Professional, Scientific, and Technical Services
- 56 Administrative and Support and Waste Management and Remediation Services
- 61 Educational Services
- 62 Health Care and Social Assistance
- 81 Other Services (except Public Administration)

IMPLAN multipliers were obtained from MIG unaggregated sectors. The BRD converted the NAICS codes to the 546-sector IMPLAN input-output model. Venture Partners license revenue to the University of Colorado was modeled in the Professional, Scientific, and Technical Services sector. While the data span five fiscal years (2018-2022), license revenue, inferred sales, and capital funding were not reported by year. All activity was modeled in 2019 dollars and presented in 2022 dollars, providing a conservative estimate of impacts.

Economic impacts are associated with license agreements, both when the technology is licensed and when the company records follow-on sales. This study quantifies sales activity directly linked to University of Colorado license agreements and estimates the economic multiplier effect of licenses and follow-on sales.

This study estimates the economic impact using the IMPLAN input-output model. Results are disseminated in terms of direct, indirect, and induced impacts on employment, labor income, value added, and output.

Economic benefits refer to dollars generated and distributed throughout the economy. The sources of impacts that sum to economic benefits include capital expenditures and operating expenditures, including the off-site spending by employees and the spending on goods and services within the supply chain.

The multiplier effect of spending within the supply chain, or the indirect impact, estimates the indirect employment and earnings generated in the study area due to the interindustry relationships between the facility and other industries. As an example, consider the University of Colorado Boulder operating the research university in Boulder, Colorado. The university employs research faculty, teaching faculty, support staff, and students for operations. In addition, the university spends on goods and services to support its operations, leading to auxiliary jobs in the community in manufacturing, transportation, wholesale, retail, and so on the **indirect impact**. Furthermore, employees spend earnings on goods and

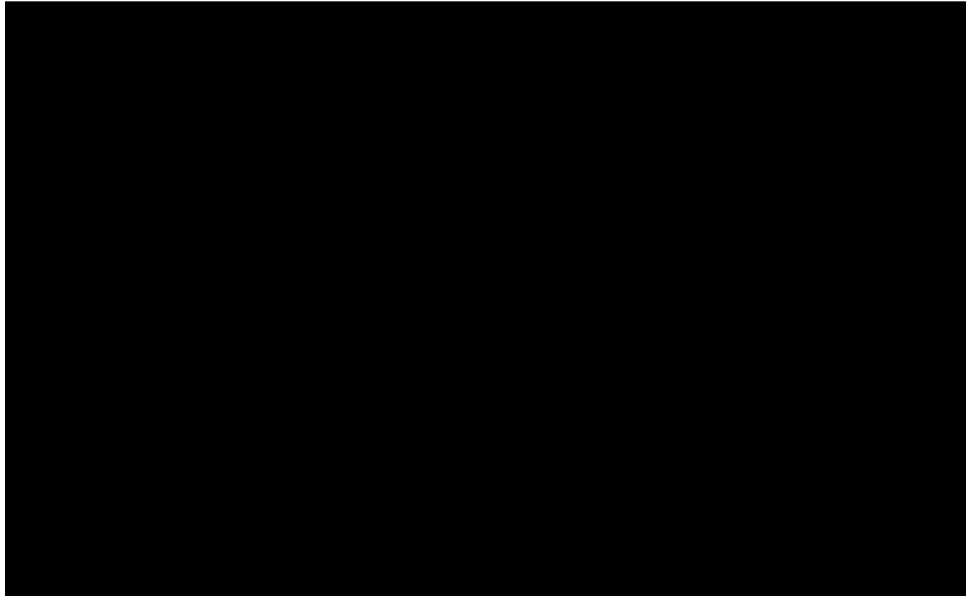
services in the community, leading to jobs in retail, accounting, entertainment, and so on the **induced impact**.

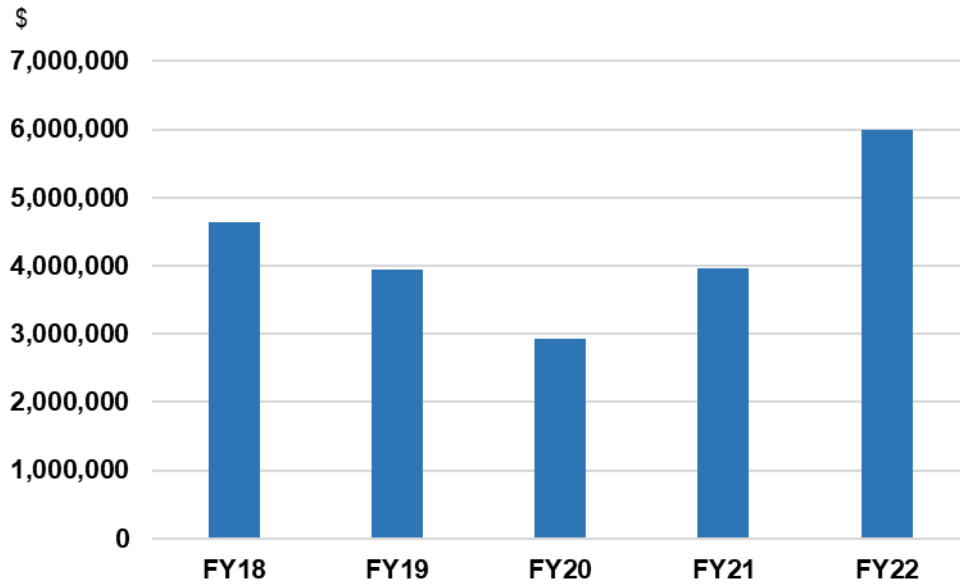
Conceptually, the multiplier effect quantifies the economic ripple effect of economic activity. This ripple effect can be positive or negative depending on if a company or industry is expanding or contracting. Multipliers are static and do not account for disruptive shifts in infrastructure without specifically addressing infrastructure changes. This model uses IMPLAN multipliers for the United States and Colorado using IMPLAN and the most current available multipliers (2020).

VENTURE PARTNERS DATA

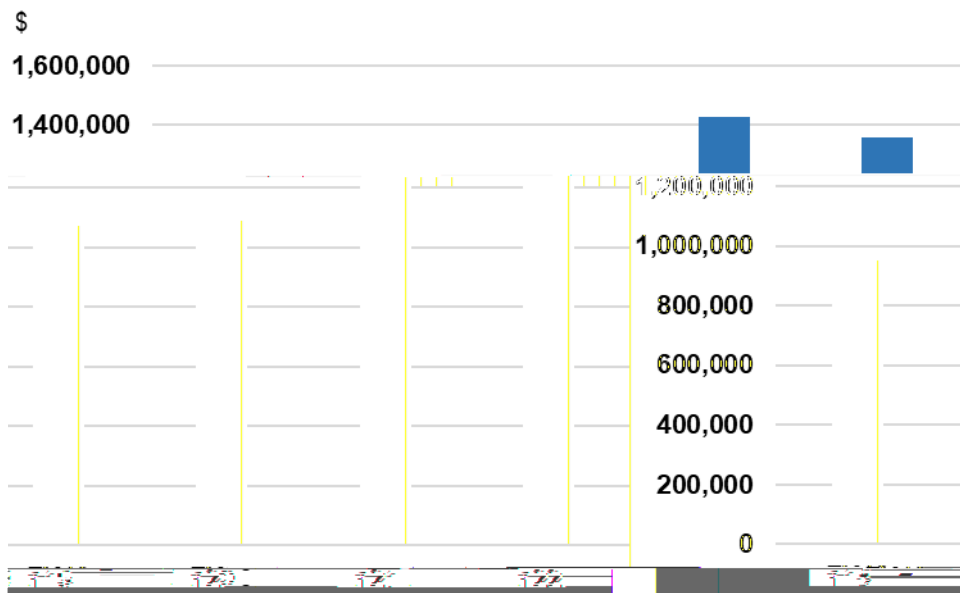
Venture Partners recorded 315 unique tech transfer agreements from fiscal year 2018 through fiscal year 2022. Of the 315 unique agreements between fiscal year 2018 and fiscal year 2022, a total of 281 paid license revenue to CU, 46 recorded follow-on sales, and 71 were CU startups that recorded a capital round.

Awards spanned 36 states and 26 countries. Information about the 272 unique agreements was spread across 310 GETQ.00000912 0 612 792 reW*nBTF3 10.98 Tf1 0 0 1 115.76 682.44 Tm0 g0 G{across453.22 Tm0 g0 G{ac





Patents protect the intellectual property of innovations developed by researchers at the University of Colorado. Venture Partners reported spending \$5.9 million on patents over the five years ending in FY2022, averaging \$1.2 million per year. Patents are a cost to Venture Partners, with a caveat that patent expenditures are reimbursable if technology (intellectual property) is licensed. Two-fifths (39.1%) were reimbursed (\$2.3 million).



impact of the license revenue totaled \$44.3 million on the state economy and \$46.2 million on the national economy. Nationally, this level of activity supported an estimated 225 job years over the five-year period (average of 45 per year), paying an estimated \$17.7 million in labor income over the five-year period. Value added, which removes the estimate of intermediate inputs, totaled \$25.6 million.

Direct Effect	81	16	\$8.8	\$10.9	\$20.1
Indirect Effect	66	13	\$4.8	\$7.0	\$13.1
Induced Effect	77	15	\$4.1	\$7.6	\$13.1
Total Effect	225	45	\$17.7	\$25.6	\$46.2

Note: Modeled in 2022 dollars with the 2019 IMPLAN data year. Results presented in 2022 dollars.

Direct Effect	81	16	\$8.8	\$10.9	\$20.1
Indirect Effect	63	13	\$4.5	\$6.6	\$12.2
Induced Effect	70	14	\$3.8	\$6.9	\$11.9
Total Effect	214	43	\$17.0	\$24.5	\$44.3

Note: Modeled in 2022 dollars with the 2019 IMPLAN data year. Results presented in 2022 dollars.

Commercialization grants include the Advanced Industries Accelerator Proof of Concept grants, Advanced Research Projects Agency-Energy (ARPA-E) grants, and startup-funded research. This funding primarily engages research and development activities on campus. Funding totaled an estimated \$45.4 million from fiscal year 2018 through fiscal year 2022. Assuming the funding is used primarily for R&D, the economic contribution totaled \$100 million on the state economy and \$104.4 billion on the national economy. Nationally, this level of activity supported an estimated 508 job years over the five-year period (average of 102 per year), paying an estimated \$39.9 million in labor income. Value added, which removes the estimate of intermediate inputs, totaled \$57.8 million. Note: commercialization grants are

Direct Effect	184	37	\$19.8	\$24.7	\$45.4
Indirect Effect	141	28	\$10.2	\$14.9	\$27.7
Induced Effect	159	32	\$8.5	\$15.7	\$26.9
Total Effect	485	97	\$38.5	\$55.3	\$100.0

Note: Modeled in 2022 dollars with the 2019 IMPLAN data year. Results presented in 2022 dollars.

Inferred revenue by licensees totaled \$1.1 billion from fiscal year 2018 through fiscal year 2022, with over 99% domestically sourced. These revenues represent total sales of the products or s68 ref687.24 Tm0 g0 8\$22(ced)]T.

estimated \$

APPENDIX 1: STUDY NAICS CODES FOLLOW-ON ACTIVITY

NAICS	Description
325199	All Other Basic Organic Chemical Manufacturing
325412	Pharmaceutical Preparation Manufacturing
325414	Biological Product (except Diagnostic) Manufacturing
325510	Paint and Coating Manufacturing
325998	All Other Miscellaneous Chemical Product and Preparation Manufacturing
334511	Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing
334515	Instrument Manufacturing for Measuring and Testing Electricity and Electrical Signals
334516	Analytical Laboratory Instrument Manufacturing
339112	Surgical and Medical Instrument Manufacturing
339999	All Other Miscellaneous Manufacturing
423490	Other Professional Equipment and Supplies Merchant Wholesalers
423830	Industrial Machinery and Equipment Merchant Wholesalers
424690	Other Chemical and Allied Products Merchant Wholesalers
513130	Book Publishers
518210	Computing Infrastructure Providers, Data Processing, Web Hosting, and Related Services
541330	Engineering Services
541380	Testing Laboratories and Services
541511	Custom Computer Programming Services
541512	Computer Systems Design Services
541519	Other Computer Related Services
541611	Administrative Management and General Management Consulting Services
541713	Research and Development in Nanotechnology
541714	Research and Development in Biotechnology (except Nanobiotechnology)
541715	Research and Development in the Physical, Engineering, and Life Sciences (except Nanotechnology and Biotechnology)
541910	Marketing Research and Public Opinion Polling
561110	Office Administrative Services
561622	Locksmiths
561990	All Other Support Services
611310	Colleges, Universities, and Professional Schools
611699	All Other Miscellaneous Schools and Instruction
611710	Educational Support Services
621111	Offices of Physicians (except Mental Health Specialists)
621511	Medical Laboratories
621999	All Other Miscellaneous Ambulatory Health Care Services
813319	Other Social Advocacy Organizations

APPENDIX 2: DATA FIELDS

Data fields provided for this study included:

- Licensee
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