The Economic Value of the Alabama Technology Network

Contents

Preface

Lightcast is a leading provider of economic impact studies and labor market data to educational institutions, workforce planners, and regional developers in the U.S. and internationally. Since 2000, Lightcast has completed over 3,000 economic impact studies for educational institutions in three countries. Along the way, we have worked to continuously update and improve our methodologies to ensure that they conform to best practices. The present study reflects the latest version of our model, representing the most up-to-date theory for conducting human capital economic impact analyses.

This model, as with previous versions, has various external data inputs which reflect the most current economic activity and data. These data include (but are not limited to): the taxpayer discount rate; the consumer savings rate; the consumer price index; state and local industry earnings as a percent of total industry earnings; and income tax brackets and sales tax by state. All data sets are maintained quarterly, although most updates occur only once a year.

These and other changes mark a considerable upgrade to the Lightcast economic impact model. Our hope is that these improvements will provide a better product for our clients – reports that are more transparent and streamlined, methodology that is more comprehensive and robust, and findings that are more relevant and meaningful to today's audiences.

While this report is useful in demonstrating the current value of the Alabama Technology Network (ATN), it is not intended for comparison with ATN's previous study conducted by Lightcast in 2023. Due to the extent of the external data changes as well as improvements to Lightcast's model since 2023, differences between results from the 2023 study and the present study do not necessarily indicate changes in the value of the network.

Lightcast encourages our readers to approach us directly with any questions or comments they may have about the study so that we can continue to improve our model and keep the public dialogue open about the positive impacts of education.

A note on comparing studies

It is important to note that the changes outlined above represent important improvements to our methodology, ultimately providing more accurate and robust results. However, these changes make it difficult to directly compare past studies to the current study, with the effectiveness of the comparison decreasing as the age of the previous study increases.

Additionally, in general Lightcast discourages comparisons between individual institutions and between educational systems since many factors, such as regional economic and political conditions, are outside of the institution's control. In addition, every institution is unique, meaning the results and types of impact or investment measures are tailored to the specific institution or educational system.

Acknowledgments

Lightcast provides colleges and universities with labor market data that help create better outcomes for students, businesses, and communities. Our data, which cover more than 99% of the U.S. workforce, are compiled from a wide variety of government sources, job postings, and online profiles and résumés. Hundreds of institutions use Lightcast to align programs with regional needs, drive enrollment, connect students with in-demand careers, track their alumni's employment outcomes, and demonstrate their institution's economic impact on their region. Visit lightcast.io/solutions/education to learn more or connect with us.

Executive summary

This report assesses the impact of the Alabama Technology Network (ATN) on the state economy and the benefits generated by the network for state and local taxpayers. The results of this study show that ATN creates a positive net impact on the state economy and generates a positive return on investment Alabama taxpayers.

Economic impact analysis

During the analysis year, ATN spent $7.4 million on payroll and benefits for 56 employees and spent another $3.4 million on goods and services to carry out its day-to-day operations. This initial round of spending creates more spending across other businesses throughout the state economy, resulting in the commonly referred to multiplier effects. This analysis estimates the net economic impact of ATN that directly accounts for the fact that state and local dollars spent on ATN could have been spent elsewhere in the state if not directed toward ATN and would have created impacts regardless. We account for this by estimating the impacts that would have been created from the alternative spending and subtracting the alternative impacts from the spending impacts of ATN.

> The additional income of $392.3 million created by ATN is equivalent to supporting 3,687 jobs in Alabama.

This analysis shows that in fiscal year (FY) 2023-24, operations spending of ATN, together with the enhanced productivity of businesses ATN supported, generated **$392.3 million** in added income for the Alabama economy. The impact of **$392.3 million** is equivalent to supporting **3,687 jobs**. These economic impacts break down as follows:

Operations spending impact

Payroll and benefits to support ATN's day-to-day operations amounted to $7.4 million. The network's non-pay expenditures amounted to $3.4 million. The net impact of operations spending by ATN in Alabama during the analysis year was approximately **$8.5 million** in added income, which is equivalent to supporting **63 jobs**.

Business support impact

The main mission of ATN is to provide extensive workforce training, technical assistance, and engineering services to Alabama businesses. These businesses will create an impact on the state economy through the retention and creation of new jobs and increased business investments, which in turn will increase demand for goods and services across the state economy. ATN helped businesses retain or grow by more than 3,000 jobs in FY 2023-24.[1]

The jobs retained or created by businesses, along with the additional spending of the businesses supported by ATN, created **$383.8 million** in added income, which is equivalent to supporting **3,624 jobs**.

Important note

When reviewing the impacts estimated in this study, it is important to note that the study reports impacts in the form of added income rather than sales. Sales includes all of the intermediary costs associated with producing goods and services, as well as money that leaks out of the state as it is spent at out-of-state businesses. Income, on the other hand, is a net measure that excludes these intermediary costs and leakages and is synonymous with gross state product (GSP) and value added. For this reason, it is a more meaningful measure of new economic activity than sales.

---

[1] The business support impact is limited to those businesses that responded to an independent third-party survey where they quantified monetary or job related impacts. The business support impact can therefore be considered conservative because it does not include all businesses ATN served in FY 2023-24.

Taxpayer investment analysis

Taxpayers provided **$5.7 million** of state and local funding to ATN in FY 2023-24. In return, taxpayers received **$37.1 million** in added tax revenue stemming from tax rates applied to ATN's operations spending, the earnings of workers whose jobs were retained or created, and increased investments of businesses because of the support of ATN. For every tax dollar spent supporting ATN, Alabama taxpayers received an average of **$6.50** in return in FY 2023-24.

For every tax dollar spent supporting ATN, taxpayers will receive an average of $6.50 in return in FY 2023-24.

Introduction

The Alabama Technology Network (ATN) was established in 1987 with the development of five "Centers of Excellence". Its purpose was to address the existing and future workforce in the state to improve economic growth. By 1996, ATN became well established, and additional locations were developed across the state, making ATN's resources easily accessible. ATN is led by Keith Phillips, Executive Director. ATN's service region, for the purpose of this report, is the state of Alabama.

While ATN affects the state in a variety of ways, many of them difficult to quantify, this study considers ATN's economic benefits. ATN's day-to-day operations and its support of state businesses help to grow the state economy through the output and employment generated by businesses. The benefits created by ATN extend as far as the state treasury in terms of the increased tax receipts.

> ATN was established in 1987 with the development of five "Centers of Excellence" to address the existing and future workforce in the state to improve economic growth.

This report assesses the impact of ATN as a whole on the state economy and the benefits generated for taxpayers. The approach is twofold. We begin with an economic impact analysis of ATN on the Alabama economy. To derive results, we rely on a specialized Multi-Regional Social Accounting Matrix (MR-SAM) model to calculate the added income created in the Alabama economy as a result of increased consumer spending and the training, technical assistance, and engineering services ATN provides. Results of the economic impact analysis are broken out according to the following impacts: 1) impact of ATN's operations spending and 2) impact of businesses supported.

The second component of the study measures the benefits generated by ATN for state and local taxpayers. The study measures the benefits to taxpayers in the form of increased tax revenues stemming from the spending of ATN and business spending as a result of the support ATN provided.

The study uses a wide array of data that are based on several sources, including the FY 2023-24 financial reports and business information from ATN; industry and employment data from the Bureau of Labor Statistics and Census Bureau; and outputs of Lightcast's impact model and MR-SAM model.

Profile of the Alabama Technology Network and the economy

The Alabama Technology Network (ATN) is a leading provider of workforce training, technical assistance, and engineering services to incumbent workers across the state of Alabama. Established in 1987 with the development of five "Centers of Excellence", ATN has a rich history of providing extensive, high-quality training, technical assistance, and engineering services in areas of Continuous Improvement, Environmental Health and Safety, Food Industry, Industrial Maintenance and Technology, and Leadership and Management Development. Since its establishment nearly 40 years ago, ATN has expanded to include a total of 21 locations throughout the state. In FY 2023-24, ATN was supported by 56 employees.

> ATN's mission is to provide the most extensive workforce training, technical assistance, and engineering services in order to improve Alabama's business and industry

ATN's mission is to provide the most extensive workforce training, technical assistance, and engineering services in order to improve Alabama's business and industry. Recognized as the Alabama Center for the National Institute of Standards and Technology (NIST) Manufacturing Extension Partnership (MEP), ATN collaborates with manufacturers providing resources, guidance, and technology. In addition, ATN provides pre-planned workshops in a range of formats, including in-person and online. Further, the network offers customized workplace training covering an array of topics that may be requested.

In addition to providing excellent opportunities for incumbent workers across Alabama, ATN is a vital asset to employers in the state. The network provides additional high-quality instruction to the state workforce and delivers flexible and responsive training opportunities through its classes and workshops, strengthening industry and raising economic prosperity across Alabama and beyond.

ATN employee and finance data

The study uses two general types of information: 1) data collected from ATN and 2) state economic data obtained from various public sources and Lightcast's proprietary data modeling tools.[2] This chapter presents the basic underlying information from ATN used in this analysis and provides an overview of the Alabama economy.

Employee data

Data provided by ATN include information on employees by place of work and by place of residence. These data appear in Table 2.1. As shown, ATN had 56 employees in FY 2023-24. Of these, all worked in the state and 98% lived in the state. These data are used to isolate the portion of the employees' payroll and household expenses that remains in the state economy.

Table 2.1: Employee data, FY 2023-24

Total employees	56
% of employees who work in the state	100%
% of employees who live in the state	98%

Source: Data provided by ATN

Revenues

Figure 2.1 shows ATN's annual revenues by funding source – a total of $10.1 million in FY 2023-24. As indicated, instructional fees comprised 17% of total revenue, and revenues from state and local government sources comprised another 55%. The federal government funded 22% and all other revenue comprised the remaining 6%. These data are critical in identifying the annual costs of ATN for state and local taxpayers.

---

[2] See Appendix 5 for a detailed description of the data sources used in the Lightcast modeling tools.

Figure 2.1: ATN revenues by source, FY 2023–24

All other revenue
6%

Instructional fees
17%

Federal
government
22%

Local government
<1%

Total revenues
$10.1 million

State government
55%
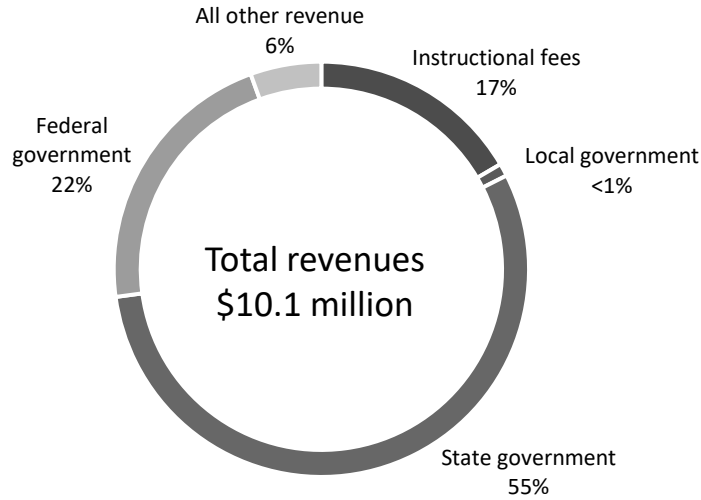
Percentages do not sum to 100% due to rounding.
Source: Data provided by ATN

Expenditures

Figure 2.2 displays ATN's expense data. The payroll at ATN, amounted to $7.4 million. This was equal to 67% of ATN's total expenses for FY 2023-24. Other expenditures, including depreciation and purchases of supplies and services, made up $3.6 million. When we calculate the impact of these expenditures in Chapter 3, we exclude depreciation expenses, as they represent a devaluation of ATN's assets rather than an outflow of expenditures.

Figure 2.2: ATN expenses by function, FY 2023–24

All other
expenditures
31%

Depreciation
1%

Total expenditures
$11.0 million

Employee salaries,
wages, & benefits
67%
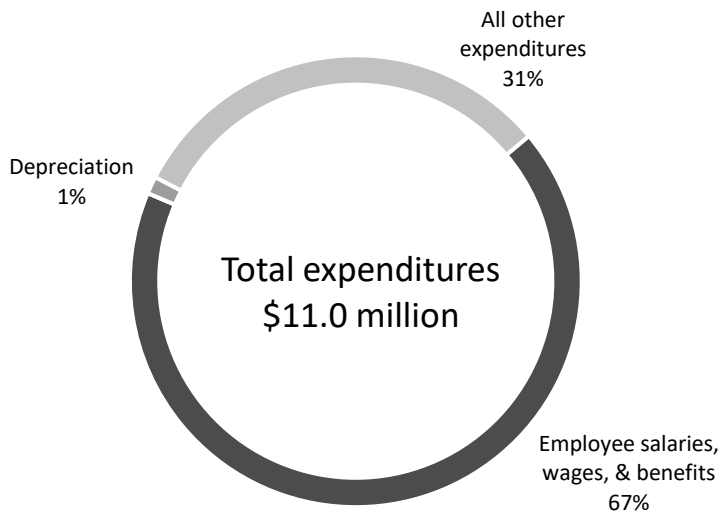
Percentages do not sum to 100% due to rounding.
Source: Data provided by ATN

The Alabama economy

Since ATN was first established, it has been serving Alabama by enhancing the workforce, providing businesses with technical assistance and engineering services. Table 2.2 summarizes the breakdown of the state economy by major industrial sector ordered by total income, with details on labor and non-labor income. Labor income refers to wages, salaries, and proprietors' income. Non-labor income refers to profits, rents, and other forms of investment income. Together, labor and non-labor income comprise the state's total income, which can also be considered the state's gross state product (GSP).

As shown in Table 2.2, the total income, or GSP, of Alabama is approximately $274.9 billion, equal to the sum of labor income ($181.5 billion) and non-labor income ($93.5 billion).

Table 2.2: Income by major industry sector in Alabama, 2023*

Industry sector	Labor income (millions)	Non-labor income (millions)	Total income (millions)+	% of total income	Sales (millions)
Manufacturing	$24,952	$25,115	$50,067	18%	$156,660
Government, Non-Education	$22,297	$7,468	$29,765	11%	$175,324
Retail Trade	$11,758	$9,511	$21,269	8%	$35,406
Finance & Insurance	$11,964	$8,465	$20,429	7%	$32,248
Health Care & Social Assistance	$17,895	$1,864	$19,759	7%	$31,144
Professional & Technical Services	$16,099	$3,018	$19,117	7%	$29,526
Wholesale Trade	$8,414	$7,061	$15,475	6%	$25,843
Construction	$11,050	$2,513	$13,563	5%	$26,289
Government, Education	$10,956	$0	$10,956	4%	$12,736
Real Estate & Rental & Leasing	$7,620	$3,124	$10,744	4%	$23,634
Utilities	$2,315	$8,047	$10,362	4%	$16,514
Transportation & Warehousing	$6,753	$2,794	$9,547	3%	$18,489
Administrative & Waste Services	$7,231	$1,410	$8,642	3%	$16,023
Accommodation & Food Services	$5,223	$2,691	$7,914	3%	$16,140
Information	$2,588	$4,576	$7,164	3%	$12,413
Other Services (except Public Administration)	$5,811	$698	$6,509	2%	$11,292
Agriculture, Forestry, Fishing & Hunting	$2,584	$2,010	$4,594	2%	$10,901
Mining, Quarrying, & Oil and Gas Extraction	$785	$2,415	$3,200	1%	$5,583
Management of Companies & Enterprises	$2,549	$177	$2,725	1%	$4,262
Educational Services	$1,546	$144	$1,690	1%	$2,368
Arts, Entertainment, & Recreation	$1,063	$352	$1,415	1%	$2,483
Total	$181,452	$93,453	$274,906	100%	$665,277

* Data reflect the most recent year for which data are available. Lightcast data are updated quarterly.
+ Numbers may not sum to totals due to rounding.
Source: Lightcast industry data

Figure 2.3 provides the breakdown of jobs by industry in Alabama. The Retail Trade sector is the largest employer, supporting 300,323 jobs or 10.1% of total employment in the state. The second largest employer is the Manufacturing sector, supporting 294,647 jobs or 9.9% of the state's total employment. Altogether, the state supports 3 million jobs.[3]

[3] Job numbers reflect Lightcast's complete employment data, which includes the following four job classes: 1) employees who are counted in the Bureau of Labor Statistics' Quarterly Census of Employment and Wages (QCEW), 2) employees who are not covered by the federal or state unemployment insurance (UI) system and are thus excluded from QCEW, 3) self-employed workers, and 4) extended proprietors.

Figure 2.3: Jobs by major industry sector in Alabama, 2023*
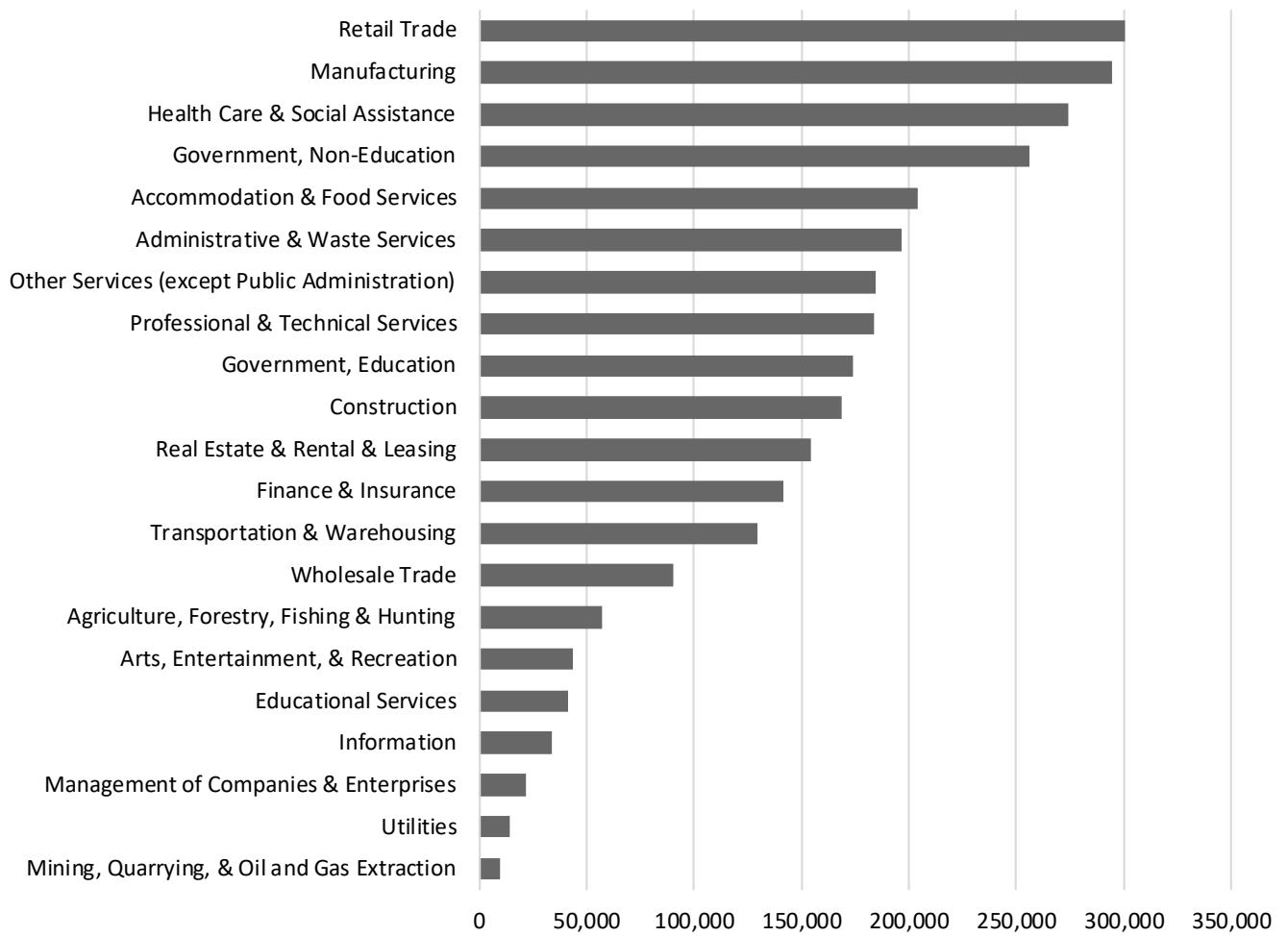
* Data reflect the most recent year for which data are available. Lightcast data are updated quarterly.

Source: Lightcast employment data

Chapter 3:

Economic impacts on the Alabama economy

ATN impacts the Alabama economy in a variety of ways. The network is an employer and buyer of goods and services. It attracts monies that otherwise would not have entered the state economy through its day-to-day operations and business support activities. Further, it serves state businesses by providing workforce training and services designed to help them sustain jobs, grow profits, and stay competitive.

In this chapter, we estimate the following economic impacts of ATN: 1) the operations spending impact and 2) the business support impact. When exploring each of these economic impacts, we consider the following hypothetical question:

How would economic activity change in Alabama if ATN did not exist in FY 2023–24?

Each of the economic impacts should be interpreted according to this hypothetical question. Another way to think about the question is to realize that we measure net impacts, not gross impacts. Gross impacts represent an upper-bound estimate in terms of capturing all activity stemming from ATN; however, net impacts reflect a truer measure of economic impact since they demonstrate what would not have existed in the state economy if not for the network.

Economic impact analyses use different types of impacts to estimate the results. The impact focused on in this study assesses the change in income. This measure is similar to the commonly used gross state product (GSP). Income may be further broken out into the **labor income impact**, also known as earnings, which assesses the change in employee compensation; and the **non-labor income impact**, which assesses the change in business profits. Together, labor income and non-labor income sum to total income.

> **Net impacts** reflect a truer measure of economic impact since they demonstrate what would not have existed in the state economy if not for ATN.

Another way to state the impact is in terms of **jobs**, a measure of the number of full- and part-time jobs that would be required to support the change in income. Finally, a frequently used measure is the **sales impact**, which comprises the change in business sales revenue in the economy as a result of increased economic activity. It is important to bear in mind, however, that

much of this sales revenue leaves the state economy through intermediary transactions and costs.[4] All of these measures – added labor and non-labor income, total income, jobs, and sales – are used to estimate the economic impact results presented in this chapter. The analysis breaks out the impact measures into different components, each based on the economic effect that caused the impact. The following is a list of each type of effect presented in this analysis:

- The **initial effect** is the exogenous shock to the economy caused by the initial spending of money, whether to pay for salaries and wages, purchase goods or services, or cover operating expenses. This effect is only represented by labor income and sales and has zero non-labor income, as the initial effect of ATN spending stems exclusively from its employees' salaries, wages, and benefits, while any other direct expenditures of ATN are reflected in the sales amount.

- The initial round of spending creates more spending in the economy, resulting in what is commonly known as the **multiplier effect**. The multiplier effect comprises the additional activity that occurs across all industries in the economy and may be further decomposed into the following three types of effects:

  - The **direct effect** refers to the additional economic activity that occurs as the industries affected by the initial effect spend money to purchase goods and services from their supply chain industries.

  - The **indirect effect** occurs as the supply chain of the initial industries creates even more activity in the economy through inter-industry spending.

  - The **induced effect** refers to the economic activity created by the household sector as the businesses affected by the initial, direct, and indirect effects raise salaries or hire more people.

The terminology used to describe the economic effects listed above differs slightly from that of other commonly used input–output models, such as IMPLAN. For example, the initial effect in this study is called the "direct effect" by IMPLAN, as shown below. Further, the term "indirect effect" as used by IMPLAN refers to the combined direct and indirect effects defined in this study. To avoid confusion, readers are encouraged to interpret the results presented in this chapter in the context of the terms and definitions listed above. Note that, regardless of the effects used to decompose the results, the total impact measures are analogous.

Lightcast	Initial	Direct	Indirect	Induced
IMPLAN	Direct	Indirect		Induced

---

[4] See Appendix 4 for an example of the intermediary costs included in the sales impact but not in the income impact.

Multiplier effects in this analysis are derived using Lightcast Multi-Regional Social Accounting Matrix (MR-SAM) input-output model that captures the interconnection of industries, government, and households in the state. The Lightcast MR-SAM contains approximately 1,000 industry sectors at the highest level of detail available in the North American Industry Classification System (NAICS) and supplies the industry-specific multipliers required to determine the impacts associated with increased activity within a given economy. For more information on the Lightcast MR-SAM model and its data sources, see Appendix 5.

Operations spending impact

Employee payroll is part of the state's total earnings, and the spending of employees for groceries, apparel, and other household expenditures helps support state businesses. ATN itself purchases supplies and services, and many of its vendors are located in Alabama. These expenditures create a ripple effect that generates still more jobs and higher wages throughout the economy.

Table 3.1 presents ATN expenditures for the following two categories: 1) salaries, wages, and benefits and 2) all other expenditures, including purchases for supplies and services. Some of this spending takes place in the state, and is therefore an injection of new money into the state economy that would not have happened if ATN did not exist. In this analysis, we exclude depreciation expenses due to the way this measure is calculated in the national input-output accounts, and because depreciation represents the devaluation of ATN's assets rather than an outflow of expenditures.[5]

The first step in estimating the multiplier effects of ATN's operational expenditures is to map these categories of expenditures to the approximately 1,000 industries of the Lightcast MR-SAM model. Assuming that the spending patterns of ATN personnel approximately match those of the average U.S. consumer, we map salaries, wages, and benefits to spending on industry outputs using national household expenditure coefficients provided by Lightcast national SAM. All ATN employees work in Alabama (see Table 2.1), and therefore we consider all of the salaries, wages, and benefits. For the other expenditure category), we assume ATN's spending patterns approximately match national

---

[5] This aligns with the economic impact guidelines set by the Association of Public and Land-Grant Universities. Ultimately, excluding these measures results in more conservative and defensible estimates.

averages and apply the national spending coefficients for NAICS 903612 (Colleges, Universities, and Professional Schools (Local Government)). [6]

Table 3.1: ATN expenses by function (excluding depreciation), FY 2023-24

Expense category	In-state expenditures (thousands)	Out-of-state expenditures (thousands)	Total expenditures (thousands)
Employee salaries, wages, and benefits	$7,435	$0	$7,435
All other expenditures	$1,254	$2,191	$3,445
Total	$8,689	$2,191	$10,880

Source: Data provided by ATN and the Lightcast impact model

We now have two vectors of expenditures for ATN: one for salaries, wages, and benefits and another for ATN's purchases of supplies and services. The next step is to estimate the portion of these expenditures that occurs inside the state. The expenditures occurring outside the state are known as leakages. We estimate in-state expenditures using regional purchase coefficients (RPCs), a measure of the overall demand for the commodities produced by each sector that is satisfied by state suppliers, for each of the approximately 1,000 industries in the MR-SAM model.[7] For example, if 40% of the demand for NAICS 541211 (Offices of Certified Public Accountants) is satisfied by state suppliers, the RPC for that industry is 40%. The remaining 60% of the demand for NAICS 541211 is provided by suppliers located outside the state. The two vectors of expenditures are multiplied, industry by industry, by the corresponding RPC to arrive at the in-state expenditures associated with ATN. See Table 3.1 for a break-out of the expenditures that occur in-state. Finally, in-state spending is entered, industry by industry, into the MR-SAM model's multiplier matrix, which in turn provides an estimate of the associated multiplier effects on state labor income, non-labor income, total income, sales, and jobs.

Table 3.2 presents the economic impact of ATN's operations spending. The people employed by ATN and their salaries, wages, and benefits comprise the initial effect, shown in the top row of the table in terms of labor income, non-labor income, total added income, sales, and jobs. The additional impacts created by the initial effect appear in the next four rows under the section labeled *multiplier effect*. Summing the initial and multiplier effects, the gross impacts are $9.5 million in labor income and $1.9 million in non-labor income. This sums to a total impact of $11.5 million in total added income

---

[6] See Appendix 1 for a definition of NAICS. Even though ATN is technically not a college, they are part of the Alabama Community College System and provide workforce training similar to a college, thus the spending pattern of Colleges, Universities, and Professional Schools (Local Government) was used.

[7] See Appendix 5 for a description of Lightcast's MR-SAM model.

associated with the spending of ATN and its employees in the state. This is equivalent to supporting 96 jobs.

Table 3.2: Operations spending impact, FY 2023-24

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Initial effect	$7,435	$0	$7,435	$10,880	56
Multiplier effect					
Direct effect	$325	$275	$600	$1,254	4
Indirect effect	$93	$61	$154	$339	1
Induced effect	$1,689	$1,586	$3,275	$5,514	35
Total multiplier effect	$2,107	$1,922	$4,029	$7,107	40
Gross impact (initial + multiplier)	$9,542	$1,922	$11,464	$17,987	96
Less alternative uses of funds	-$1,531	-$1,449	-$2,979	-$5,952	-33
Net impact	$8,012	$473	$8,484	$12,035	63

Source: Lightcast impact model

The $11.5 million in gross impact is often reported by researchers as the total impact. We go a step further to arrive at a net impact by applying a counterfactual scenario, i.e., what would have happened if a given event – in this case, the expenditure of in-state funds on ATN – had not occurred. ATN received an estimated 78% of its funding from sources within Alabama. This portion of the network's funding came from instructional fees paid by businesses receiving ATN's services, and from state and local taxpayer funding and other revenue sources. We must account for the opportunity cost of this in-state funding. Had other industries received these monies rather than ATN, income impacts would have still been created in the economy. In economic analysis, impacts that occur under counterfactual conditions are used to offset the impacts that actually occur in order to derive the true impact of the event under analysis.

> The total net impact of ATN's operations is $8.5 million in total added income, which is equivalent to supporting 63 jobs.

We estimate this counterfactual by simulating a scenario where in-state monies spent on ATN are instead spent on consumer goods and savings. This simulates the in-state monies being returned to the taxpayers and being spent by the household sector. Our approach is to establish the total amount spent by in-state businesses and taxpayers on ATN, map this to the detailed industries of the MR-SAM model using national household expenditure coefficients, use the industry RPCs to estimate in-state spending, and

run the in-state spending through the MR-SAM model's multiplier matrix to derive multiplier effects. The results of this exercise are shown as negative values in the row labeled *less alternative uses of funds* in Table 3.2.

The total net impact of ATN's operations is equal to the gross impact less the impact of the alternative use of funds – the opportunity cost of the state money. As shown in the last row of Table 3.2, the total net impact is approximately $8.0 million in labor income and $472.8 thousand in non-labor income. This sums together to $8.5 million in total added income and is equivalent to supporting 63 jobs. These impacts represent new economic activity created in the state economy solely attributable to the operations of ATN.

Business Support Impact

Next, we consider the economic impact of the jobs retained and created by businesses ATN supports. To calculate this impact, ATN provided Lightcast data on the businesses they supported in FY 2023–24 and the number of jobs retained and created by those businesses. Of the businesses ATN supported in FY 2023–24, 201 manufacturers responded to an independent third–party survey where they quantified monetary or jobs related impacts. Because of the support ATN provided, these businesses were able to retain 2,485 jobs and create 566 jobs in Alabama. These 3,051 workers are estimated to have made $298.2 million in earnings in FY 2023–24. This can be found as the initial labor income in Table 3.4.

In addition to the jobs retained and supported, ATN helps businesses reduce their costs in certain areas, as well as avoid unnecessary investments. In FY 2023–24, ATN helped businesses save $59.4 million from unnecessary costs and investments. This allowed businesses to invest further in areas that will make them more productive and profitable. Businesses were able to grow and invest in new products or processes, plant or equipment, systems or software, workforce practices/employee skills, or other areas of the business because of the support of ATN. Businesses invested $93.3 million in growing their businesses because of the services ATN provided in FY 2023–24.

Of the $93.3 million in new investments, $59.4 million would have been spent anyway if ATN had not helped the businesses save money from unnecessary costs and investments. Therefore, we only consider $33.9 million in net additional investments by the businesses supported by ATN (Table 3.3). Keep in mind that businesses are likely to experience long–run benefits from reallocating their

spending. These future long-run benefits are not considered in this analysis. The $33.9 million in additional spending by the businesses, along with the $298.2 million spent paying either retained or hired employees, makes up the $332.1 million in the initial sales impact in Table 3.4.

Table 3.3: Business increase in financial activity because of ATN, FY 2023–24

Business financial activity	Total expenditures (millions)
Increased investment in new products or processes	$19.7
Increased investment in plant or equipment	$36.3
Increased investment in information systems or software	$6.0
Increased investment in workforce practices/employee skills	$28.1
Increased investment in other areas of business	$3.2
Gross total increased investment	**$93.3**
Less cost savings	$49.8
Less avoided/saved investments	$9.7
Total savings	**$59.4**
Net total increased investment	**$33.9**
Retained and growth in employee earnings	**$298.2**
Net total business financial activity	**$332.1**

Source: Data provided by ATN and the Lightcast impact model

ATN provided the six-digit NAICS code of each business. We assume the businesses will have earnings and spending patterns – or production functions – similar to their respective industry averages. We use industry-specific jobs-to-earnings and earnings-to-sales ratios to estimate the sales of each business. Once we have the sales estimates, we follow a similar methodology as outlined in the previous section by running sales through the MR-SAM to generate the direct, indirect, and induced multiplier effects (Table 3.4).

The total impact from ATN's business support in Alabama sums to $383.8 million, the sum of $353.3 million in labor income and $30.6 million in non-labor income. This is equivalent to supporting 3,624 jobs in the state (including the 3,051 jobs initially retained and created).[8]

Table 3.4: Business support impact, FY 2023-24

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Initial effect	$298,209	$599	$298,808	$332,089	3,051
Multiplier effect					
Direct effect	$17,289	$10,868	$28,157	$74,903	184
Indirect effect	$5,427	$3,307	$8,734	$23,110	58
Induced effect	$32,332	$15,784	$48,116	$112,956	332
Total multiplier effect	$55,049	$29,959	$85,008	$210,968	573
Total impact (initial + multiplier)	$353,258	$30,558	$383,816	$543,057	3,624

Source: Lightcast impact model

Total ATN impact

The total economic impact of ATN on Alabama can be generalized into two types of impacts. First, ATN generates a flow of spending that has a substantial impact on the state economy. The impact of this spending is captured by the operations spending impact. While not insignificant, these impacts do not capture the true purpose of ATN. The basic mission of ATN is to provide the most extensive workforce training, technical assistance, and engineering services in order to improve Alabama's business and industry. Every year, the network supports businesses in Alabama, helping them retain jobs, grow their workforce, and become more productive and efficient.

Table 3.5 displays the grand total impacts of ATN on the Alabama economy in FY 2023-24. The total added value of ATN is **$392.3 million**, which is equivalent to supporting **3,687 jobs** in FY 2023-24.

Table 3.5: Total ATN impact, FY 2023-24

	Labor income (thousands)	Non-labor income (thousands)	Total income (thousands)	Sales (thousands)	Jobs supported
Operations spending	$8,012	$473	$8,484	$12,035	63
Business support	$353,258	$30,558	$383,816	$543,057	3,624
Total impact	$361,270	$31,031	$392,300	$555,092	3,687

Source: Lightcast impact model

Chapter 4:

Taxpayer investment analysis

Investment analysis is the process of evaluating total costs and measuring these against total benefits to determine whether a proposed venture will be profitable. If benefits outweigh costs, the investment is worthwhile. If costs outweigh benefits, the investment will lose money and could be considered infeasible. In this chapter, we evaluate ATN as an investment from the perspective of taxpayers.

ATN paid its employees $7.4 million in payroll in FY 2023-24, increasing the labor income in Alabama. When ATN spends money on its non-pay expenses, the network grows the state economy. By spending money on state businesses, ATN helps make the businesses more profitable, increasing the non-labor income. Labor income and non-labor income, in turn, increase tax revenues since the local government can apply tax rates to spending, properties, and business profits.

A benefit-cost ratio of **6.5** means ATN is a good public investment since the taxes from ATN's spending and support of businesses not only recover taxpayer costs but grow the Alabama tax base.

The pivotal step is to determine the public benefits that specifically accrue to state and local government. Estimating the effect of ATN on increased tax revenues begins with looking at the network's impact on Alabama. The spending of ATN increases Alabama's Gross State Product (GSP). To the increase in GSP, we apply a rate of taxes on production and imports as a percentage of GSP to capture the tax revenues received by the state and local governments from this additional GSP. Only tax revenues as a result of ATN spending money and consequent business growth are considered. In all instances, benefits to private residents, local businesses, or the federal government are excluded. Total taxpayer benefits amount to $37.1 million in added taxes in FY 2023-24.

Taxpayer costs are reported in Figure 1.1 and come to $5.7 million, equal to the contribution of state and local government to ATN. In return for their public support, taxpayers are rewarded with an investment benefit-cost ratio of 6.5 (= $37.1 million ÷ $5.7 million), indicating a profitable investment. In other words, for every dollar of public money invested in ATN in FY 2023-24, taxpayers will receive a cumulative present value of $6.50.

Conclusion

While ATN adds value to Alabama beyond the economic impact outlined in this study, the value of ATN's impact in terms of dollars and cents is an important component of ATN's value as a whole. In order to fully assess ATN's value to the state economy, this report has evaluated the network from the perspectives of economic impact analysis and investment analysis.

From an economic impact perspective, we calculated that ATN generates a total economic impact of **$392.3 million** in total added income for the state economy. This represents the sum of two impacts:

- Operations spending impact (**$8.5 million**) and
- Business support impact (**$383.8 million**).

The total impact of $392.3 million is equivalent to supporting **3,687 jobs**.

Since ATN's activity represents an investment by state and local taxpayers, we measure the return on investment to Alabama taxpayers. In return for state and local taxpayer investment, ATN expands the state economy and grows the state's tax base. For each dollar invested by taxpayers, ATN offers a benefit of **$6.50**. These results indicate that ATN is an attractive investment to taxpayers.

The total impact of **$392.3 million** is equivalent to supporting **3,687 jobs**.

Resources and appendices

Resources and references

Bureau of Labor Statistics. Consumer Price Index. "All items in U.S. city average, all urban consumers, not seasonally adjusted." https://data.bls.gov/timeseries/CUUR0000SA0?years_option=all_years.

Federal Deposit Insurance Corporation. "Monthly Rate Cap Information as of March 2023." National Rates and Rate Caps – Monthly Update. https://www.fdic.gov/regulations/resources/rates/.

Federal Reserve Economic Data. "Gross Domestic Product: Implicit Price Deflator, Index 2012=100, Quarterly, Seasonally Adjusted." March 2023. https://fred.stlouisfed.org/series/GDPDEF.

Henderson, James M. and Richard E. Quandt. *Microeconomic Theory: A Mathematical Approach*. New York: McGraw-Hill Book Company, 1971.

Lightcast Labor Market Data and Software. https://lightcast.io/.

OECD (2023). "Household savings." https://data.oecd.org/hha/household-savings.htm#indicator-chart.

Office of Management and Budget. Discount Rates for Cost-Effectiveness, Lease Purchase, and Related Analyses. Revised February 17, 2023. Accessed March 2024. https://www.whitehouse.gov/wp-content/uploads/2023/02/M-23-12-Appendix-C-Update_Discount-Rates.pdf.

Office of Management and Budget. "Table 14.1 – Total Government Receipts in Absolute Amounts and as Percentages of GDP: 1948-2023." OMB Historical Tables. https://www.whitehouse.gov/omb/historical-tables/.

Timothy Vermeer. Tax Foundation. "State Individual Income Tax Rates and Brackets, 2023." February 2024. https://taxfoundation.org/data/all/state/state-income-tax-rates-2024/.

U.S. Census Bureau. "National Population by Characteristics: 2020-2022" "Annual Estimates of the Resident Population for Selected Age Groups by Sex for the United States: April 1, 2020 to July 1, 2021." https://www.census.gov/data/tables/2020/demo/popest/2020-demographic-analysis-tables.html.

Watson et al. "Determining Economic Contributions and Impacts: What is the difference and why do we care?" The Journal of Regional Analysis & Policy 37, no.2 (2007): 140-146.

Appendix 1: Glossary of terms

Alternative use of funds A measure of how monies that are currently used to fund ATN might otherwise have been used if the network did not exist.

Benefit–cost ratio Present value of benefits divided by present value of costs. If the benefit–cost ratio is greater than 1.0, then benefits exceed costs, and the investment is feasible.

Counterfactual scenario What would have happened if a given event had not occurred. In the case of this economic impact study, the counterfactual scenario is a scenario where ATN did not exist.

Earnings (labor income) Income that is received as a result of labor; i.e., wages.

Economics Study of the allocation of scarce resources among alternative and competing ends. Economics is not normative (what ought to be done), but positive (describes what is, or how people are likely to behave in response to economic changes).

Gross state product Measure of the final value of all goods and services produced in a state after netting out the cost of goods used in production. Alternatively, gross state product (GSP) equals the combined incomes of all factors of production; i.e., labor, land, and capital. These include wages, salaries, proprietors' incomes, profits, rents, and other. Gross state product is also sometimes called value added or added income.

Initial effect Income generated by the initial injection of monies into the economy through the payroll of ATN.

Input–output analysis Relationship between a given set of demands for final goods and services and the implied amounts of manufactured inputs, raw materials, and labor that this requires. When educational institutions pay wages and salaries and spend money for supplies in the state, they also generate earnings in all sectors of the economy, thereby increasing the demand for goods and services and jobs.

Multiplier effect Additional income created in the economy as ATN spends money in the state. It consists of the income created by the supply chain of the industries initially affected by the spending of ATN (i.e., the direct effect),

income created by the supply chain of the initial supply chain (i.e., the indirect effect), and the income created by the increased spending of the household sector (i.e., the induced effect).

NAICS
The North American Industry Classification System (NAICS) classifies North American business establishments in order to better collect, analyze, and publish statistical data related to the business economy.

Non-labor income
Income received from investments, such as rent, interest, and dividends.

Appendix 2: Frequently asked questions (FAQs)

This appendix provides answers to some frequently asked questions about the results.

What is economic impact analysis?

Economic impact analysis quantifies the impact from a given economic event – in this case, the presence of ATN – on the economy of a specified region.

What is investment analysis?

Investment analysis is a standard method for determining whether an existing or proposed investment is economically viable. This methodology is appropriate in situations where a stakeholder puts up a certain amount of money with the expectation of receiving benefits in return.

Do the results differ by region, and if so, why?

Yes. Regional economic data are drawn from Lightcast's proprietary MR-SAM model, the Census Bureau, and other sources to reflect jobs numbers, population demographics, and other key characteristics of the state. Therefore, model results for ATN are specific to the given region.

Are the funds transferred to ATN increasing in value, or simply being re-directed?

Lightcast's approach is not a simple "rearranging of the furniture" where the impact of operations spending is essentially a restatement of the level of funding received by ATN. Rather, it is an impact assessment of the additional income created in the region as a result of ATN's spending on payroll and other non-pay expenditures, net of any impacts that would have occurred anyway if the network did not exist.

Lightcast conducted an economic impact study for ATN a couple years ago. Why have results changed?

Lightcast is a leading provider of economic impact studies and labor market data to educational institutions, workforce planners, and regional developers in the U.S. and internationally. Since 2000, Lightcast has completed over 3,000 economic impact studies for educational institutions in three countries. Along the way we have worked to continuously update and improve our methodologies to

ensure that they conform to best practices and stay relevant in today's economy. The present study reflects the latest version of our model, representing the most up-to-date theory, practices, and data for conducting economic impact and investment analyses. Many of our former assumptions have been replaced with observed data, and we have researched the latest sources in order to update the background data used in our model. Additionally, changes in the data ATN provides to Lightcast can influence the results of the study.

Appendix 3: Example of sales versus income

Lightcast's economic impact study differs from many other studies because we prefer to report the impacts in terms of income rather than sales (or output). Income is synonymous with value added or gross state product (GSP). Sales include all the intermediary costs associated with producing goods and services. Income is a net measure that excludes these intermediary costs:

Income = Sales − Intermediary Costs

For this reason, income is a more meaningful measure of new economic activity than reporting sales. This is evidenced by the use of gross domestic product (GDP) – a measure of income – by economists when considering the economic growth or size of a country. The difference is GSP reflects a state and GDP a country.

To demonstrate the difference between income and sales, let us consider an example of a baker's production of a loaf of bread. The baker buys the ingredients such as eggs, flour, and yeast for $2.00. He uses capital such as a mixer to combine the ingredients and an oven to bake the bread and convert it into a final product. Overhead costs for these steps are $1.00. Total intermediary costs are $3.00. The baker then sells the loaf of bread for $5.00.

The sales amount of the loaf of bread is $5.00. The income from the loaf of bread is equal to the sales amount less the intermediary costs:

Income = $5.00 − $3.00 = $2.00

In our analysis, we provide context behind the income figures by also reporting the associated number of jobs. The impacts are also reported in sales and earnings terms for reference.

Appendix 4: Lightcast MR–SAM

Lightcast's MR-SAM represents the flow of all economic transactions in a given region. It replaces Lightcast's previous input-output (IO) model, which operated with some 1,000 industries, four layers of government, a single household consumption sector, and an investment sector. The old IO model was used to simulate the ripple effects (*i.e.*, multipliers) in the regional economy as a result of industries entering or exiting the region. The MR-SAM model performs the same tasks as the old IO model, but it also does much more. Along with the same 1,000 industries, government, household, and investment sectors embedded in the old IO tool, the MR-SAM exhibits much more functionality, a greater amount of data, and a higher level of detail on the demographic and occupational components of jobs (16 demographic cohorts and about 750 occupations are characterized).

This appendix presents a high-level overview of the MR-SAM. Additional documentation on the technical aspects of the model is available upon request.

Data sources for the model

The Lightcast MR-SAM model relies on a number of internal and external data sources, mostly compiled by the federal government. What follows is a listing and short explanation of our sources. The use of these data will be covered in more detail later in this appendix.

Lightcast Data are produced from many data sources to produce detailed industry, occupation, and demographic jobs and earnings data at the local level. This information (especially sales-to-jobs ratios derived from jobs and earnings-to-sales ratios) is used to help regionalize the national matrices as well as to disaggregate them into more detailed industries than are normally available.

BEA Make and Use Tables (MUT) are the basis for input-output models in the U.S. The *make* table is a matrix that describes the amount of each commodity made by each industry in a given year. Industries are placed in the rows and commodities in the columns. The *use* table is a matrix that describes the amount of each commodity used by each industry in a given year. In the use table, commodities are placed in the rows and industries in the columns. The BEA produces two different sets of MUTs, the benchmark and the summary. The benchmark set contains about 500 sectors and is released every five years, with a five-year lag time (e.g., 2002 benchmark MUTs were released in 2007). The summary set contains about 80 sectors and is released every year, with a two-year lag (e.g., 2010 summary MUTs were released in late 2011/early 2012). The MUTs are used in the Lightcast MR-SAM model to produce an industry-by-industry matrix describing all industry purchases from all industries.

BEA Gross Domestic Product by State (GSP) describes gross domestic product from the value added (also known as added income) perspective. Value added is equal to employee compensation, gross operating surplus, and taxes on production and imports, less subsidies. Each of these components is reported for each state and an aggregate group of industries. This dataset is updated once per year, with a one-year lag. The Lightcast MR–SAM model makes use of this data as a control and pegs certain pieces of the model to values from this dataset.

BEA National Income and Product Accounts (NIPA) cover a wide variety of economic measures for the nation, including gross domestic product (GDP), sources of output, and distribution of income. This dataset is updated periodically throughout the year and can be between a month and several years old depending on the specific account. NIPA data are used in many of the Lightcast MR–SAM processes as both controls and seeds.

BEA Local Area Income (LPI) encapsulates multiple tables with geographies down to the county level. The following two tables are specifically used: CA05 (Personal income and earnings by industry) and CA91 (Gross flow of earnings). CA91 is used when creating the commuting submodel and CA05 is used in several processes to help with place-of-work and place-of-residence differences, as well as to calculate personal income, transfers, dividends, interest, and rent.

Bureau of Labor Statistics Consumer Expenditure Survey (CEX) reports on the buying habits of consumers along with some information as to their income, consumer unit, and demographics. Lightcast utilizes this data heavily in the creation of the national demographic by income type consumption on industries.

Census of Government's (CoG) state and local government finance dataset is used specifically to aid breaking out state and local data that is reported in the MUTs. This allows Lightcast to have unique production functions for each of its state and local government sectors.

Census' OnTheMap (OTM) is a collection of three datasets for the census block level for multiple years. **Origin–Destination (OD)** offers job totals associated with both home census blocks and a work census block. **Residence Area Characteristics (RAC)** offers jobs totaled by home census block. **Workplace Area Characteristics (WAC)** offers jobs totaled by work census block. All three of these are used in the commuting submodel to gain better estimates of earnings by industry that may be counted as commuting. This dataset has holes for specific years and regions. These holes are filled with Census' Journey-to-Work described later.

Census' Current Population Survey (CPS) is used as the basis for the demographic breakout data of the MR–SAM model. This set is used to estimate the ratios of demographic cohorts and their income for the three different income categories (i.e., wages, property income, and transfers).

Census' Journey-to-Work (JtW) is part of the 2000 Census and describes the amount of commuting jobs between counties. This set is used to fill in the areas where OTM does not have data.

Census' American Community Survey (ACS) Public Use Microdata Sample (PUMS) is the replacement for Census' long form and is used by Lightcast to fill the holes in the CPS data.

Oak Ridge National Lab (ORNL) County-to-County Distance Matrix (Skim Tree) contains a matrix of distances and network impedances between each county via various modes of transportation such as highway, railroad, water, and combined highway-rail. Also included in this set are minimum impedances utilizing the best combination of paths. The ORNL distance matrix is used in Lightcast's gravitational flows model that estimates the amount of trade between counties in the country.

Overview of the MR-SAM model

Lightcast's MR-SAM modeling system is a comparative static model in the same general class as RIMS II (Bureau of Economic Analysis) and IMPLAN (Minnesota Implan Group). The MR-SAM model is thus not an econometric model, the primary example of which is PolicyInsight by REMI. It relies on a matrix representation of industry-to-industry purchasing patterns originally based on national data which are regionalized with the use of local data and mathematical manipulation (i.e., non-survey methods). Models of this type estimate the ripple effects of changes in jobs, earnings, or sales in one or more industries upon other industries in a region.

The Lightcast MR-SAM model shows final equilibrium impacts – that is, the user enters a change that perturbs the economy and the model shows the changes required to establish a new equilibrium. As such, it is not a dynamic model that shows year-by-year changes over time (as REMI's does).

National SAM

Following standard practice, the SAM model appears as a square matrix, with each row sum exactly equaling the corresponding column sum. Reflecting its kinship with the standard Leontief input-output framework, individual SAM elements show accounting flows between row and column sectors during a chosen base year. Read across rows, SAM entries show the flow of funds into column accounts (also known as receipts or the appropriation of funds by those column accounts). Read down columns, SAM entries show the flow of funds into row accounts (also known as expenditures or the dispersal of funds to those row accounts).

The SAM may be broken into three different aggregation layers: broad accounts, sub-accounts, and detailed accounts. The broad layer is the most aggregate and will be covered first. Broad accounts cover between one and four sub-accounts, which in turn cover many detailed accounts. This

appendix will not discuss detailed accounts directly because of their number. For example, in the industry broad account, there are two sub-accounts and over 1,000 detailed accounts.

Multi-regional aspect of the MR-SAM

Multi-regional (MR) describes a non-survey model that has the ability to analyze the transactions and ripple effects (i.e., multipliers) of not just a single region, but multiple regions interacting with each other. Regions in this case are made up of a collection of counties.

Lightcast's multi-regional model is built off of gravitational flows, assuming that the larger a county's economy, the more influence it will have on the surrounding counties' purchases and sales. The equation behind this model is essentially the same that Isaac Newton used to calculate the gravitational pull between planets and stars. In Newton's equation, the masses of both objects are multiplied, then divided by the distance separating them and multiplied by a constant. In Lightcast's model, the masses are replaced with the supply of a sector for one county and the demand for that same sector from another county. The distance is replaced with an impedance value that considers the distance, type of roads, rail lines, and other modes of transportation. Once this is calculated for every county-to-county pair, a set of mathematical operations is performed to make sure all counties absorb the correct amount of supply from every county and the correct amount of demand from every county. These operations produce more than 200 million data points.

Components of the Lightcast MR-SAM model

The Lightcast MR-SAM is built from a number of different components that are gathered together to display information whenever a user selects a region. What follows is a description of each of these components and how each is created. Lightcast's internally created data are used to a great extent throughout the processes described below, but its creation is not described in this appendix.

County earnings distribution matrix

The county earnings distribution matrices describe the earnings spent by every industry on every occupation for a year – i.e., earnings by occupation. The matrices are built utilizing Lightcast's industry earnings, occupational average earnings, and staffing patterns.

Each matrix starts with a region's staffing pattern matrix which is multiplied by the industry jobs vector. This produces the number of occupational jobs in each industry for the region. Next, the occupational average hourly earnings per job are multiplied by 2,080 hours, which converts the average hourly earnings into a yearly estimate. Then the matrix of occupational jobs is multiplied by the occupational annual earnings per job, converting it into earnings values. Last, all earnings are adjusted to match the

known industry totals. This is a fairly simple process, but one that is very important. These matrices describe the place-of-work earnings used by the MR-SAM.

Commuting model

The commuting sub-model is an integral part of Lightcast's MR-SAM model. It allows the regional and multi-regional models to know what amount of the earnings can be attributed to place-of-residence vs. place-of-work. The commuting data describe the flow of earnings from any county to any other county (including within the counties themselves). For this situation, the commuted earnings are not just a single value describing total earnings flows over a complete year but are broken out by occupation and demographic. Breaking out the earnings allows for analysis of place-of-residence and place-of-work earnings. These data are created using Bureau of Labor Statistics' OnTheMap dataset, Census' Journey-to-Work, BEA's LPI CA91 and CA05 tables, and some of Lightcast's data. The process incorporates the cleanup and disaggregation of the OnTheMap data, the estimation of a closed system of county inflows and outflows of earnings, and the creation of finalized commuting data.

National SAM

The national SAM as described above is made up of several different components. Many of the elements discussed are filled in with values from the national Z matrix – or industry-to-industry transaction matrix. This matrix is built from BEA data that describe which industries make and use what commodities at the national level. These data are manipulated with some industry standard equations to produce the national Z matrix. The data in the Z matrix act as the basis for the majority of the data in the national SAM. The rest of the values are filled in with data from the county earnings distribution matrices, the commuting data, and the BEA's National Income and Product Accounts.

One of the major issues that affect any SAM project is the combination of data from multiple sources that may not be consistent with one another. Matrix balancing is the broad name for the techniques used to correct this problem. Lightcast uses a modification of the "diagonal similarity scaling" algorithm to balance the national SAM.

Gravitational flows model

The most important piece of the Lightcast MR-SAM model is the gravitational flows model that produces county-by-county regional purchasing coefficients (RPCs). RPCs estimate how much an industry purchases from other industries inside and outside of the defined region. This information is critical for calculating all IO models.

Gravity modeling starts with the creation of an impedance matrix that values the difficulty of moving a product from county to county. For each sector, an impedance matrix is created based on a set of

distance impedance methods for that sector. A distance impedance method is one of the measurements reported in the Oak Ridge National Laboratory's County-to-County Distance Matrix. In this matrix, every county-to-county relationship is accounted for in six measures: great-circle distance, highway impedance, rail miles, rail impedance, water impedance, and highway-rail-highway impedance. Next, using the impedance information, the trade flows for each industry in every county are solved for. The result is an estimate of multi-regional flows from every county to every county. These flows are divided by each respective county's demand to produce multi-regional RPCs.