

SOUTH DAKOTA SCHOOL OF MINES AND TECHNOLOGY'S
CONTRIBUTIONS TO STATE AND COUNTY ECONOMIC DEVELOPMENT

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Executive Summary:

This report quantifies several of the ways in which the South Dakota School of Mines and Technology enhances economic development in the state and Pennington County. Results show that, including multiplier effects, the institution's day-to-day operations along with student and visitor spending annually contribute an estimated \$108.1 million in total output to the South Dakota economy, and support 1,379 full- and part-time jobs that provide \$37.7 million in income to South Dakota workers. With a leverage factor of 8.17, the results indicate that every \$1.00 of state government appropriation invested in the School of Mines is associated with approximately \$8.17 in total statewide economic activity. The total impact of the South Dakota School of Mines and Technology on the Pennington County economy is an estimated \$101.3 million. Looking at the benefits of School of Mines graduates, the results suggest that the annual earnings premium associated with in-state alumni is \$82.5 million of additional income to the South Dakota economy.

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1. INTRODUCTION

Founded in 1885, the South Dakota School of Mines and Technology offers a wide range of science- and technology-based undergraduate and graduate programs that educate and inspire the next generation of scientific researchers, innovators and leaders. In addition, School of Mines faculty and students are involved in research projects, which attract substantial external funding, that further our knowledge about science and its many applications. Graduates of the South Dakota School of Mines and Technology possess the skills and experience needed to excel in the South Dakota workforce and around the world.

This report highlights several of the ways in which the South Dakota School of Mines and Technology enhances the state and local economies. First, we examine the economic contribution of the School of Mines' operations and student (and visitor) spending on sales output, employment and income. This analysis focuses on the institution's impact on the overall South Dakota economy as well as its impact on Pennington County. As one might expect, the School of Mines has a substantial impact on its surrounding county, where it purchases a lot of goods and services, and faculty and student spending occurs. The institution's operations and related spending enhance the entire South Dakota economy, beyond Pennington County, through its in-state purchases and the flow of indirect expenditures among businesses and individuals.

The second part of the study looks at the benefits that School of Mines graduates provide to the South Dakota economy. This analysis focuses on the earnings premium

associated with a college degree in South Dakota, with an emphasis on science- and technology-based occupations. In South Dakota and nationwide, scientists and engineers provide a substantial boost to the economy through, among other things, new discoveries and innovations that improve existing products and services. These activities are reflected in the high wages and salaries earned by scientists and engineers in the workplace.

Before proceeding with the analysis, we offer a few caveats that should be kept in mind when interpreting the study findings. First, our examination of the School of Mines' economic impact is based on the entire scope of its activities; not just those that are generated by out-of-state revenue sources. Some of the spending from in-state sources (e.g., resident student tuition) could represent a redistribution of revenue among South Dakota colleges and universities. However, the focused nature of the School of Mines' programs suggests that its primary competition for students may come from similar institutions located outside of South Dakota.¹ In addition, non-resident tuition and federal grant funding provide key sources of new money to the South Dakota economy.

Second, our analysis of School of Mines graduates who live in South Dakota assumes that they are employed as scientists or engineers. Although this assumption is somewhat realistic for recent graduates, it is more problematic for older graduates who may have retired or otherwise left the workforce.² However, it is beyond the scope of this project to determine the exact employment status of School of Mines alumni. To

¹ The tuition revenue from in-state students who would have otherwise attended a university outside of South Dakota can be counted as a type of "new money" to the state economy.

² Retired individuals continue to impact the economy through volunteer work and spending financed by savings and pension funds.

overcome this limitation, we focus our analysis on in-state alumni who graduated in 1960 or later.

Finally, this study does not claim to capture all of the impacts of the School of Mines on the state and local regions. Our analysis focuses on the economic impact (e.g., output, employment and income) of the institution's operations and related spending, as well as the wages and salaries earned by alumni who live in South Dakota. However, it does not explicitly account for, among other things, the value of new discoveries that come out of faculty and student research, the impacts associated with businesses started by School of Mines faculty and students, or the institution's fiscal (i.e., state and local government taxes) impacts.

2. SCHOOL OF MINES' CONTRIBUTIONS TO THE SOUTH DAKOTA AND PENNINGTON COUNTY ECONOMIES

The South Dakota School of Mines and Technology generates substantial economic activity through its day-to-day operations. This includes the institution's spending on goods and services purchased in the region, and payroll expenditures. During FY2007, the School of Mines received \$42.3 million in revenues from a variety of sources (see Table 1).³ Key out-of-state revenue sources include federal grants and contracts (\$7.0 million), and tuition and fees paid by non-resident students. Close to one-third (690 of 2,124 students) of the student body is classified as non-resident students. The primary sources of funding from the South Dakota government are the state appropriation (\$13.2 million) and state grants and contracts (\$1.0 million).

³ Information presented in this section of the report was provided by the South Dakota School of Mines and Technology.

The School of Mines' in-state, non-payroll expenditures on goods and services totaled \$9.5 million in FY2007.⁴ Payroll represents the institution's largest expenditure category, with \$21.4 million spent in FY2007 on wages and salaries of faculty, professional staff, classified workers and students. The School of Mines directly employed 770 full- and part-time workers in FY2007; 396 of these employees were student workers.

Table 2 presents information on the statewide economic contribution of the School of Mines' day-to-day operations.⁵ Student and visitor spending, other key components of the institution's total economic impact, are considered in a separate analysis. The direct impacts associated with the institution's operations are the revenue (i.e., output), payroll (i.e., income) and employment figures discussed above. The multiplier effects, estimated using the IMPLAN model for the state of South Dakota, capture the indirect and induced impacts associated with the in-state expenditures made by the School of Mines (e.g., products and services purchased from South Dakota businesses) and its employees.

Along with the economic activity summarized in Table 2, School of Mines student and visitor spending contribute to the South Dakota economy. A portion of the impact of student spending is captured in the figures shown in Table 2 because the direct income of \$21.4 million (and its associated multiplier effects) includes \$3.1 million in

⁴ In-state expenditures were determined through an analysis of accounting records provided by the School of Mines. The institution's non-payroll expenditures totaled \$23.2 million during FY2007. Of this amount, \$9.5 million was matched to a zip code located in South Dakota. These in-state expenditures do not include reimbursements for out-of-state travel because, although matched to a South Dakota zip code, they cover spending that occurred elsewhere.

⁵ The direct impact figures shown in Table 2 include 29 workers employed by the SDSM&T Foundation, and a corresponding payroll of \$721,528. The Foundation's activities are not included in the direct output figure of \$42.3 million. However, the multiplier effects capture the estimated in-state expenditures made by the Foundation.

wages paid to student workers. However, the total expenditures made by School of Mines students far exceed the spending from wages earned through on-campus jobs. This is because student expenditures are also financed through sources such as parental support, money earned through off-campus and “summer” jobs, and student financial aid. Using information on the composition of the School of Mines’ student body (e.g., full-versus part-time students, on- versus off-campus housing) and average expenditures for housing, food, transportation and personal items, we estimate that School of Mines students spent approximately \$14.8 million on goods and services.⁶

The difference between the \$14.8 million in estimated student expenditures and the \$3.1 million received in student wages, which amounts to \$11.7 million in direct spending, is another source of in-state economic activity associated with the South Dakota School of Mines and Technology. In addition, visitors to the campus provide an impact to the state economy. Figures from the School of Mines count an estimated 25,230 on-campus visitors during FY2007. Results from a visitor survey conducted by the South Dakota Office of Tourism indicate that the typical traveler in South Dakota spent \$73.92 per person in 2006.⁷ This spending estimate applied to the total number of on-campus visitors results in direct visitor impact of \$1.9 million. Visitor spending combined with the student expenditures not accounted for by wages earned through on-campus jobs translates into \$13.6 million in additional direct economic activity associated

⁶ Housing and food expenditures are included for full-time students who live in off-campus housing. The economic activity associated with room and board expenditures made by resident students is captured in the figures shown in Table 2. Student expenditures are based on sample budgets provided by the South Dakota School of Mines and Technology.

⁷ The 2007 Annual Report of the South Dakota Office of Tourism shows an average daily expenditure of \$221.77 for a travel party of three people. From this figure, we estimate an average daily expenditure of \$73.92 per person.

with the South Dakota School of Mines and Technology. The total impact of this spending, estimated using the South Dakota IMPLAN model, is shown in Table 3.⁸

Table 4 summarizes the South Dakota School of Mines and Technology's total contribution to the state economy. These figures include the sales output generated by operations of the institution, employee and visitor spending, and the activity associated with visitors to campus. The School of Mines has a state-level output multiplier of 1.93, calculated as its total economic contribution (\$108.1 million) divided by its direct output (\$55.9 million). This suggests that every \$1.00 in revenue and student/visitor spending generates \$1.93 in total spending across the state. The income multiplier of 1.48 indicates that every \$1.00 of income associated with the School of Mines' payroll or the direct spending of students and visitors generates \$1.48 in total income across the state. Finally, the employment multiplier of 1.43 suggests that every worker employed by the School of Mines or directly associated with the spending of students and visitors supports a total of 1.43 workers across the state.

Given the institution's reliance on funding from the South Dakota government as a key source of revenue, it is appropriate to examine the ratio of total economic output relative to the state appropriation. This ratio represents a "leverage factor" of the extent to which the School of Mines supplements its state appropriation through other revenue sources, which then determines the total economic impact. Based on the figures shown in Table 4 and the total state appropriation of \$13.2 million, we estimate a leverage factor of

⁸ The direct and multiplier effects of visitor spending are \$1,865,102 and \$1,187,885, respectively. Thus, visitor spending annually contributes an estimated \$3,052,987 in total output to the South Dakota economy. The direct and multiplier effects of student spending (above what is received from on-campus jobs) are \$11,730,634 and \$6,292,419, respectively. This suggests that the additional student spending contributes an estimated \$18,023,053 in total output to the South Dakota economy. The combined impacts of visitor and student spending are shown in Table 3.

8.17 for FY2007. This suggests that every \$1.00 provided by the state appropriation is associated with approximately \$8.17 in total statewide economic activity, counting multiplier effects. Including state grants and contracts (\$1.0 million) as part of the South Dakota government's investment in the School of Mines, we estimate a slightly lower leverage factor of 7.57.

School of Mines' Contributions to the Pennington County Economy

Given the campus' home in Rapid City, a substantial portion of the South Dakota School of Mines and Technology's economic impact is felt in Pennington County. This is the area where students and School of Mines employees live, and where much of their spending occurs. Tables 5 to 7 summarize the impacts of the South Dakota School of Mines and Technology on the Pennington County economy. The direct output, income and employment associated with the institution's operations, shown in Table 5, are similar to the direct impacts at the state level. This is because the institution's output is generated by activities that take place on campus, and that its employees work in Pennington County.

The county- and state-level multiplier effects are different because in-state spending exceeds expenditures made within Pennington County. Records provided by the School of Mines show \$9.5 million of in-state spending compared to \$8.9 million of expenditures that take place in Pennington County.⁹ This difference of about \$600,000 in spending contributes, in part, to a higher state-level multiplier. Multipliers of all types are generally higher for larger geographical areas (e.g., states) than for smaller regions (e.g., counties). This is because the economies of smaller areas typically have higher

⁹ See footnote #4 for a brief explanation of how these expenditures were calculated.

“leakages” in which money is spent outside the region. Since more inclusive regions capture a larger proportion of indirect spending, multiplier effects tend to be higher.

Likewise, the county- and state-level direct impacts associated with student and visitor spending are similar. This is because we assume that the expenditures made by students (e.g., housing, food) and campus visitors occur in Pennington County.¹⁰ Once again, the county-level multiplier effects in Table 6 are smaller than the state-level multiplier effects shown in Table 3. As in the previous analysis, this is because a higher portion of indirect spending is captured by the state economy as compared to the Pennington County economy. Figures shown in Table 7 summarize the total impact of the South Dakota School of Mines and Technology on the Pennington County economy. The institution and its related activities support \$101.3 million in total economic output, and 1,304 jobs that provide \$36.5 million in income.¹¹

3. BENEFITS OF SCHOOL OF MINES GRADUATES TO THE SOUTH DAKOTA ECONOMY

Along with the substantial economic impacts associated with its day-to-day operations and student/visitor spending, the South Dakota School of Mines and Technology provides a benefit to the regional economy through its graduates who live and work in the state. Information provided by the School of Mines show that 2,526 former graduates live in South Dakota. Of these alumni, 2,407 graduated from the

¹⁰ Detailed surveys would be needed to determine the exact location of student and visitor spending. Without this information, we assume that these expenditures occur in Pennington County.

¹¹ To put these numbers into perspective, 2005 *County Business Patterns* data from the U.S. Census Bureau show total Pennington County employment and payroll of 42,654 and \$1,187,667,000, respectively. The total FY2007 employment and income impacts of School of Mines operations and student/visitor spending are equivalent to about 3.2 percent of these county totals from 2005.

institution since 1960 (see Table 8). Many of these graduates are likely working in the state in a scientific or technical occupation.¹²

One measure of the estimated benefits provided by School of Mines graduates to the South Dakota economy is the additional labor earnings associated with the degree granted by the institution. U.S. Census figures from the 2006 American Community Survey show average earnings of \$18,756 for individuals in South Dakota with no more than a high school degree (or its equivalent).¹³ By comparison, the average 2006 earnings of South Dakota residents with an Associates Degree, B.A./B.S., M.A./M.S. or Ph.D. are \$28,039, \$35,823, \$40,006 and \$54,734, respectively. The difference between these earnings levels and the average amount received by someone without a college degree is a measure of the estimated “earnings premium” associated with higher education. Applying these figures to post-1960, in-state graduates from the School of Mines (see Table 9), we arrive at a collective annual earnings premium of \$41.6 million.

However, this simple calculation likely severely understates the additional earnings associated with School of Mines graduates. This is because jobs in science- and technology-based fields typically offer considerably higher compensation than the average job. The information shown in Table 10 suggests that School of Mines graduates are almost certain to work in science and technology occupations. In-state alumni have degrees in fields such as civil engineering, mechanical engineering, electrical engineering, and other similar programs.

¹² In the introduction, we discuss a study limitation related to our assumption about the labor force status of in-state alumni. In the absence of detailed employment surveys, we assume that in-state, post-1960 graduates are employed as scientists or engineers in South Dakota.

¹³ These earnings figures are for individuals who are active in the labor force. This includes full- and part-time workers.

Along with the earnings premium associated with a college degree (based on all occupations), Table 11 also presents estimates of the earnings premium associated with a college degree in a science and technology occupation.¹⁴ Due to the relatively small number of individuals in these fields included in the 2006 American Community Survey for South Dakota, we were unable to calculate average earnings in the science and technology occupations for each of the separate degree categories.¹⁵ Instead, we calculated average earnings in science and technology occupations for individuals with at least a 4-year college degree and similar average earnings across all occupations. Not surprisingly, we find that the average South Dakota resident with at least a 4-year college degree working in a science and technology occupation makes 1.47 times as much as the average 4-year college graduate.

Given the small sample sizes noted above, we applied this ratio to estimate the degree-specific average earnings of South Dakota workers in science and technology occupations. As shown in the far right column of Table 11, a comparison of these estimates to the average earnings of South Dakota workers with no more than a high school diploma (\$18,756) results in substantial annual earnings premiums associated with higher education in science- and technology-based fields. Applying these premiums to the number of School of Mines post-1960 graduates living in South Dakota, we arrive at an annual collective earnings premium of \$82.5 million in additional earnings above those with only a high school degree (see Table 12).

¹⁴ The science and technology occupations include, among others, computer scientists, mechanical engineers, electrical engineers, chemical engineers, industrial engineers, chemists, physicists and mathematicians.

¹⁵ The 2006 American Community Survey includes 8,044 individual person records for South Dakota. Of these individuals, 4,297 people are active in the labor force. Of those that are in the labor force, only 55 work in the science and technology occupations considered in the analysis.

4. SUMMARY

This report looked at several of the ways in which the South Dakota School of Mines and Technology enhances economic development in the state and local region. We found that, including multiplier effects, the institution's day-to-day operations and student/visitor spending contribute \$108.1 million in total output (i.e., sales) to the South Dakota economy, and support 1,379 full- and part-time jobs that provide \$37.7 million in income to South Dakota workers. In addition, with a leverage factor of 8.17, our analysis shows that every \$1.00 invested by the South Dakota government in the School of Mines' appropriation is associated with approximately \$8.17 in total statewide economic activity. Focusing on the benefits of School of Mines graduates, we found that the annual earnings premium associated with in-state alumni is \$82.5 million of additional income to the South Dakota economy. This substantial impact associated with School of Mines alumni is due to the high wages and salaries earned by workers in science- and technology-based occupations.

Table 1. SDSM&T Revenue Sources, FY07

Source	Amount*
State Appropriation General Fund	\$13,232,576
Tuition and Fee Allocation	\$6,172,650
Other Tuition and Fees	\$6,543,687
Auxiliary Sales and Services	\$1,848,886
Federal Grants and Contracts	\$7,010,311
State Grants and Contracts	\$1,046,956
Private Grants and Contracts	\$810,970
General Sales and Services	\$988,023
Other	\$4,665,738
Total	\$42,319,797

* Information provided by the South Dakota School of Mines and Technology.

Table 2. Statewide Economic Impact of SDSM&T Operations

	Direct Impact	Multiplier Effect***	Total Impact***
Output	\$42,319,797	\$44,694,023	\$87,013,820
Income*	\$21,406,517	\$10,209,662	\$31,616,179
Employment**	770	342	1,112

* Direct impact is the total university payroll, including benefits and student payroll.

** Direct impact includes student employment, which is often part-time, seasonal and highly variable.

*** Estimated using the South Dakota IMPLAN model.

Table 3. Statewide Economic Impact of SDSM&T Student and Visitor Spending*

	Direct Impact**	Multiplier Effect***	Total Impact***
Output	\$13,595,736	\$7,480,304	\$21,076,040
Income	\$3,970,767	\$2,082,089	\$6,052,856
Employment	196	71	267

* Student spending does not include money earned from on-campus employment. The impacts of student payroll are included in Table 2.

** Direct income and employment figures are estimated using the South Dakota IMPLAN model.

** Estimated using the South Dakota IMPLAN model.

Table 4. Statewide Economic Impact of SDSM&T: Operations, Student and Visitor Spending*

	Direct Impact	Multiplier Effect	Total Impact
Output	\$55,915,533	\$52,174,327	\$108,089,860
Income	\$25,377,284	\$12,289,751	\$37,669,035
Employment	966	413	1,379

* All figures are combined totals of the impacts presented in Tables 2 and 3.

Table 5. County-Level Economic Impact of SDSM&T Operations

	Direct Impact	Multiplier Effect***	Total Impact***
Output	\$42,319,797	\$39,929,499	\$82,249,296
Income*	\$21,406,517	\$9,386,624	\$30,386,624
Employment**	770	285	1,055

* Direct impact is the total university payroll, including benefits and student payroll.

** Direct impact includes student employment, which is often part-time, seasonal and highly variable.

*** Estimated using the IMPLAN model for Pennington County, South Dakota.

Table 6. County-Level Economic Impact of SDSM&T Student and Visitor Spending*

	Direct Impact**	Multiplier Effect***	Total Impact***
Output	\$13,595,736	\$5,421,043	\$19,016,779
Income	\$3,970,767	\$1,742,185	\$5,712,952
Employment	196	53	249

* Student spending does not include money earned from on-campus employment. The impacts of student payroll are included in Table 5.

** Direct income and employment figures are estimated using the IMPLAN model for Pennington County, South Dakota.

*** Estimated using the IMPLAN model for Pennington County, South Dakota.

Table 7. County-Level Economic Impact of SDSM&T: Operations, Student and Visitor Spending*

	Direct Impact	Multiplier Effect	Total Impact
Output	\$55,915,533	\$45,350,542	\$101,266,075
Income	\$25,377,284	\$11,128,809	\$36,506,093
Employment	966	338	1,304

* All figures are combined totals of the impacts presented in Tables 5 and 6.

Table 8. SDSM&T In-state Alumni, Totals by Year of Graduation

Year of Graduation	# Graduates Living in South Dakota*
2006	116
2005	110
2004	96
2003	104
2002	92
2001	66
2000	77
1995-1999	342
1990-1994	314
1985-1989	256
1980-1984	232
1975-1979	164
1970-1974	241
1965-1969	114
1960-1964	83
Pre 1960	119
Total	2,526

* Information provided by the South Dakota School of Mines and Technology.

Table 9. SDSM&T In-state Alumni, Totals by Degree

Degree	# Graduates Living in South Dakota*
Associates Degree	24
Bachelor of Science	2,254
Master of Science	118
Doctoral Programs	11
Total	2,407

* Does not include alumni who graduated before 1960.

Table 10. SDSM&T In-state Alumni, Totals by Program

Program	# Graduates Living in South Dakota*
Civil Engineering	468
Mechanical Engineering	441
Electrical Engineering	258
Interdisciplinary Sciences	184
Chemical Engineering	153
Computer Science	145
Geological Engineering	139
Chemistry	101
Industrial Engineering	94
Mining Engineering and Management	74
Mathematics	72
Metallurgical Engineering	65
Computer Engineering	53
Geology	42
Physics	32
General Studies	24
Technology Management	20
Other	42
Total	2,407

* Does not include alumni who graduated before 1960.

Table 11. Annual (2006) Earnings Premiums Associated with Higher Education in South Dakota*

Degree	Average SD Earnings: All Occupations	Premium Relative to No College Degree**	Average SD Earnings: Science & Technology Occupations***	SD Science and Technology Earnings Premium Relative to No College Degree**
Associates Degree	\$28,039	\$9,283	\$41,272	\$22,516
B.A./B.S.	\$35,823	\$17,067	\$52,730	\$33,974
M.A./M.S.	\$40,006	\$21,250	\$58,887	\$40,131
Doctoral Programs	\$54,734	\$35,978	\$80,566	\$61,810

* Calculated using information from the 2006 American Community Survey, U.S. Census Bureau.

** Premium calculations based on average earnings of \$18,756 for individuals with no more than a high school diploma (or equivalent).

*** Figures are estimated based on a 1.472 ratio of average earnings in science and technology occupations relative to average earnings in all occupations, calculated using information on individuals with at least a 4-year college degree. This ratio is applied to the earnings figures in the column with the heading of "Average SD Earnings: All Occupations." Degree-specific earnings information for science and technology occupations is unavailable due to the small sample size of South Dakota residents (in these occupations) in the 2006 American Community Survey.

Table 12. Annual (2006) Statewide Earnings Premiums Associated with SDSM&T Graduates

Degree	# Graduates Living in South Dakota*	SD Science and Technology Earnings Premium Relative to No College Degree**	Earnings Premiums Associated with SDSM&T Graduates
Associates Degree	24	\$22,516	\$540,384
Bachelor of Science	2,254	\$33,974	\$76,577,396
Master of Science	118	\$40,131	\$4,735,458
Doctoral Programs	11	\$61,810	\$679,910
			total: \$82,533,148

* Does not include alumni who graduated before 1960.

** Information is from the far right column of Table 11.