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Idaho's Minerals Industry a flow-of-product analysis

Merle L. Newell
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IDAHO BUREAU OF MINES AND GEOLOGY

MOSCOW, IDAHO

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IDAHO'S MINERALS INDUSTRY: A FLOW-OF-PRODUCT ANALYSIS

By

Merle L. Newell and R. D. Peterson

INTRODUCTION

Regional economics has become an important vehicle for growth and development of communities, states, and even to specific industries during the post-World War II period. Two primary tasks of the economist are to identify important cause-and-effect relationships and to be creative in the adaptation of research techniques while doing so. This study fulfills both requirements because, in addition to describing a new dimension of activity about a significant segment of Idaho's economy, the analysis represents a unique application of a contemporary method of regional economics.

Idaho's minerals industry holds a key position in the development of the state's economy. As a supplier of raw materials to other industries within Idaho and as an exporter of raw materials to firms outside the state, the minerals industry is classed as a basic industry. A basic industry is considered a prime mover in an economy since money flows into an area in return for exports of goods and/or services. Dollars brought into the state by the prime mover are released to other industries and individuals in the form of purchases, wages, taxes, and further transactions.

The relation of the minerals industry to the economy of Idaho has been largely unexplored, and the extent to which it facilitates other industries within the state is not known. Economic activities associated with the minerals industry are understood only to a limited extent; an understanding of these activities can be beneficial to the state in planning for industrial growth and increased employment.

National, state, and local planning efforts are currently being emphasized by many state and local industrial-development committees. Most of these efforts seek to improve the short- and long-run economic position of the area being studied. Due to complex business relations much detailed information is needed to analyze adequately a region's economic potential. Consequently, many different types of studies are used to provide adequate information. Current detailed information must be acquired to support planning and decision making. This study is an attempt to supply needed information about the minerals industry and its economic value to the State of Idaho.

A better understanding of the interrelations among industries can aid industrial development of the state. Some companies, such as phosphate processing firms, gain freight advantages by locating close to sources of mineral supply. These enterprises handle a low-unit-value product as well as one that requires large amounts of low-cost electric power. Both

proximity to supply and low-cost electric power are found in Idaho. Industrial development of this type can utilize the mineral wealth of the state to an economic advantage both for the state and its citizens.

A product-flow table was used to show the interrelations of the minerals industry with other industries in the state. Sales and purchase dollars were used as a unit of measurement to represent the flow of goods and services among industries. Transactions in a flow table are arranged so that sales from one industry to another can be read horizontally across the table, while purchases by a specific industry shown at the top of the table can be read vertically down the column. Such a table provides information on: (1) the flow of goods and services associated with Idaho's minerals industry, both to other sectors within the state as well as exports from the state; (2) the contribution of the minerals industry to Idaho's economy; and (3) the measurement of income and employment effects.

Mineral wealth associated with Idaho's water resources was not included in this study. The gas and oil industry, which is mainly a transmission and distribution industry rather than a production industry, also was not considered.

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DEFINITIONS OF TERMS

General terms used in this study are explained separately from those terms used in the product-flow table. This division is made so that special emphasis can be given the product-flow table and its individual segments. A better understanding of the table can be achieved by describing its parts in order.

General Terms Used in Study

Economic Activity.

This term is used to define the study of production, distribution, and consumption of goods and services. For this study, economic activity means the sales and purchases of goods and/or services.

Minerals Industry.

An industry refers to a broad group of enterprises engaged in similar activities. When these firms are aggregated, they can be called an industry. For example, the minerals industry includes those firms involved in mining, quarrying, milling (crushing, screening, washing, flotation, etc.), smelting, and other preparation needed to render a marketable product.

Nonbasic Industry.

A nonbasic industry is one that supplies and/or facilitates a basic industry. Consequently, economic activity in a nonbasic industry is closely tied to that of the basic industry. A measurable and often stable relationship usually exists between basic and facilitating industry groups.

Direct Sales and Purchases.

This activity reflects direct sales by the minerals industry to other industries, as well as direct purchases by the minerals industry from other enterprises. For example, wages paid to households (i.e., labor purchased by firms) are a direct transaction; wages spent by households represent an indirect purchase of households.

Indirect Sales and Purchases.

Transactions that follow direct exchanges are called indirect sales and purchases. That is, timber purchased for a mine (a direct transaction) requires the lumber industry to purchase goods and services, such as equipment, labor, and other items (an indirect purchase).

Terms Used in Product-Flow Table

A product-flow table is the term given to a table, arranged in a unique way, that is used to show sales and purchases of products among industries represented in the table. Generally, some industries are combined into one unit, called a "sector." In this study those sectors were maintained that gave the best representation of the real economy. Three main segments make up the product-flow table; they are: (1) Processing Sector, (2) Final Demand Sector, and (3) Payments Sector. Each of these segments is composed of a number of interrelated sectors.

Processing Sector.

This sector is made up of those firms that produce and/or process mineral

products. Industries having the greatest dollar value of production were selected as representative sectors; they are:

Lead and Zinc. The lead and zinc industry was designated as one industry since they are almost inseparably combined in their production process. Firms included in this sector produce joint products such as lead, zinc, silver, copper, and gold. Idaho's smelter and zinc plants are also included in this sector as processors of mineral products.

Silver. This sector includes the separate silver producing firms and the portion of silver production that could be separated from the producers of lead-zinc products. Silver production continues to be a major item, in terms of value, of mineral production within the state.

Copper. The copper sector includes the separate copper producing firms and the portion of copper production that could be separated from the producers of joint products. Copper production in Idaho is mostly a by-product from silver production.

Phosphate. Both mining and processing of phosphate are included in this sector. The processing firms would be classed as a manufacturing industry under the Standard Industrial Classification (called "S. I. C. code"), but they are included in the minerals industry for this study since they are so closely related to and dependent upon the mining industry. This sector is a growing industrial segment of the state's economy.

Other. This grouping includes that portion of the metals industry which could not be identified with a specific industry, such as gold and antimony, and it also includes clay products. To prevent disclosure of confidential data, the smaller producers and single producers of a product, were aggregated into this sector.

Final Demand Sector.

Sectors included in this section are: (1) construction, (2) metal fabricators, (3) lumber, (4) retail and wholesale, and (5) exports. Since only minor amounts of sales are made to the first four sectors, the following explanation will suffice for these four sectors. Sales and products from the processing sectors are assumed to be used or consumed by the final demand sector. Products sold within the state may be used for further manufacturing, but the sale is considered a final demand by the minerals industry.

Exports. Included in this sector are sales by the processing sectors to firms located outside the state's boundaries. Idaho mineral products are sold to export markets and in return dollars flow into the minerals industries from sources outside the state.

Payments Sectors.

Industries that sell goods and services to the processing sectors make up

the payments sector. This group of firms facilitate the processing sectors by supplying goods and/or services.

Construction. The minerals industry expends funds for repairs and maintenance as well as for capital improvements. This sector does not include the amounts spent for capital improvements.

Metal Fabricators. This sector is relatively unimportant in Idaho since the majority of metal products are exported for further manufacturing. However, development of this industry could bring further industrial growth to the state.

Lumber. The lumber industry sells timber products to the mining industry for use in support of mine workings. Almost all of this facilitating activity is within the Coeur d'Alene mining region.

Retail and Wholesale. Purchases of goods and services, such as mine supplies, explosives, steel, and other items from facilitating industries are included in this sector. Also included in this sector are products sold to retail and wholesale establishments by mining firms.

Services. Any operating industry uses the goods and services provided by various firms, including legal, utilities, and communication firms, to name only a few. These firms facilitate the mining industry by supplying goods and services.

Capital Improvements. This sector includes those payments for new capital assets and equipment whose expected usefulness is more than one year. The portion of these purchases coming from out of state are included as imports.

Imports. This sector includes that portion of each sector that could be identified as purchased outside the state. Included in this group are some purchases of capital improvements, services, and from other facilitating sectors, as well as imports of ore concentrates.

Payments to Government. This sector includes payments to the government in the form of taxes. Taxes provide some services by state and local government to industry.

Households. Households include the wages paid to workers within the mineral industries. Wages are in turn used to make indirect purchases of goods and services from other industries, such as retail and wholesale firms.

Value Added. This is a balancing entry used to account for such items as federal income tax, depreciation, interest, profits, and changes in inventories. A balanced table is assumed in a product-flow study so the value-added figure is used to adjust inputs to outputs thereby making them equal.

METHODS OF REGIONAL ANALYSIS

Any one of several methods may be used to analyze the production, distribution, and consumption of goods and services within an economic area. Such an economic area can be arbitrarily defined according to any convenient meaningful criteria; for example, a community, state, region, or a nation may be used (Tiebout, 1962, p. 13). For the purposes of this study, the region was defined as the minerals industry within the State of Idaho.

Some of the most widely used methods of anlaysis are: (1) Economic Base Analysis, (2) Input-Output Analysis, (3) Regional Analysis, (4) Interregional Analysis, and (5) Product-Flow Analysis. Most of these methods are applicable to this type of study but a product-flow analysis was chosen because it could be modified to yield the desired results at a minimum cost. Each of these techniques is described briefly in this section.

Economic Base Analysis

An economic base study can be used to identify the key economic activities within an area or community. Identifying these key activities helps to develop the information needed for an area to solve its economic problems in the employment of land, labor, and resources. Economic base studies have been used as a preliminary study in many cases due to their lower cost and less rigorous approach.

Input-Output Analysis

Input-output studies have shown increased popularity in recent years due to their analytical approach. Input-output analysis attempts to define inputs of goods and/or services into an area as well as to define the outputs of goods and/or services from that area. Such an appraisal seeks to describe an area of study in quantitative terms by building a model of the area's economy in the form of a table or matrix. Input-output studies have been used on a regional as well as a national scale in the United States and in other nations. Extensive amounts of data are necessary to build a table with even a small number of sectors; hence, its cost may be large. However, its usefulness has been shown to be worthy of the extra effort.

Regional Analysis

A regional study defines a particular area or region within some definite boundaries and then seeks to analyze that region in depth (Chenery and Clark, 1966, p. 66). This approach may also be extended into an input-output type of model for the region. The benefits of a regional study are that an area can be reduced to manageable units and those units explored in depth.

Interregional Analysis

Interregional analysis extends the regional analysis into a study of the

transfer of goods and services between two or more regions. This method usually involves some sort of a table or matrix and in many ways is closely related to an input-output study.

Product-Flow Analysis

A simple product-flow analysis is concerned with the physical flow of goods and services between regions or areas. In some cases, this flow may be represented in pictorial terms, dollar terms, or units of production. A product-flow analysis reveals the importance of exports as well as imports in a regional economy. When a product flow analysis is incorporated with a modified input-output table, the study can explore a region's economy at a minimal cost. Although such a study does not always provide all the needed details, it often supplies a good preliminary groundwork for further analysis.

Comparison of Methods

Each of the preceding methods may involve a type of table or matrix to show the interrelationship of one industry to another. These connections, which represent a flow of goods and/or services, may be shown in units of sales dollars, units of employment, or any other measure that is meaningful for the study. Each method has a special purpose and application; however, various modifications may cause one method to closely resemble another method. These techniques are similar, however, in that each one attempts to measure the transfer of goods and/or services for an economic purpose.

LIMITATIONS TO THE STUDY

One of the major limitations to any project of this type is that the information needed to do a comprehensive study is often not available or cannot be obtained. Neither the industries nor any other organization provides information broken down by the categories needed for the study. Consequently, much of the data were estimates, as well as bits and pieces of information gleaned from numerous sources rather than actual accounting data. All of these data were then assembled into this composite study. Accounting information is generally kept for purposes other than this type of study; hence, it was used only to a limited extent. Some specific limitations are discussed in the following paragraphs.

1. One problem in product-flow analysis involves the identification of products and the resulting grouping of industries into sectors. The amount of aggregation necessary tends to discount some of the smaller producing industries since different products may be grouped into one sector.
2. Some firms produce joint products; therefore, some method of allocating a portion of total sales to individual products was necessary. Even though accepted accounting methods were used, certain basic assumptions limit the accuracy of the results.

3. The S. I. C. Classification limits the minerals industry almost entirely to the mining process. Any further processing of mineral products comes under a manufacturing classification instead of a mining or minerals industry classification. For this study, however, mineral processors are included as part of the minerals industry. Since this economic activity is related to and dependent upon the mining industry, it would seem logical that it should be included in the minerals industry.

4. Most mineral production in Idaho is from a few large producers. In conducting the study, an effort was made to obtain information from all of the largest firms. Since many smaller firms do not contribute much to total state output, most smaller firms were not included in the survey. The error introduced by this method was considered to be insignificant.

However, in spite of these limitations, this study represents a reasonable first approximation of the interrelationships that do exist between Idaho's minerals industry and other industries in the state. Although precise information on these relationships was not available, reasonable estimates were supplied by minerals industry personnel. Information obtained from published sources was also used to present a careful and objective analysis of the industry as it exists.

IDAHO'S MINERALS INDUSTRY

Idaho's minerals industry has ranked as the number one industry in the state for many years. In 1965, it ranked third in the state, following agriculture and manufacturing. Some growth in the manufacturing classification is attributable to mineral processing firms. These mineral processing firms, although classed as manufacturing firms in the S. I. C. code, depend upon Idaho mining interests for minerals to process. Their location and growth can be credited almost entirely to Idaho's mineral production.

HISTORICAL BACKGROUND

Development of the Western United States and especially Idaho Territory has been attributed to the gold rush and ensuing mining activites. Discovery of gold in Idaho in 1860 by E. D. Pierce provided the impetus that was necessary to start a full-scale exploration and development of the new territory. Early gold mining activity resulted in the growth of the city of Lewiston, Idaho, and in its selection as the first state capitol. In some instances, mining activity has produced short-run economic expansions which have left depressed areas or "ghost" towns after exploitation of the minerals. Ironically, some ghost towns have economic importance as tourist attractions. Idaho's mineral production has, however, passed from the glamorous gold rush activity into a more stable and long-run base-metal production. Moreover, the state is now entering an era of economic growth and development in the phosphate industry.

In 1965, total mineral production amounted to $105,085,000 (Collins, Knostman and Petersen, 1965, p. 262). This figure is the value of the metallic minerals that were sold on the market plus the value of the nonmetallic minerals including raw phosphate rock mined in the state. The value of raw phosphate rock is considerably less than the total sales of phosphate products. Hence, a more adequate measure of the sales of phosphate products would increase the value of mineral production within the state.

Idaho ranks as the nation's largest producer of silver, and second largest producer of lead and zinc (Hansen, 1965, p.22). This record production has come almost entirely from the Coeur d'Alene mining district in northern Idaho. Production from this district is expected to continue for some time since the limits of the ore bodies are not yet determined.

Dividends paid by mining companies have also benefitted the local and surrounding communities. Firms in the Coeur d'Alene mining district have paid a total of $298,791,913 in dividends from 1886 to 1965. In 1965 alone, seven firms paid a total of $6,469,020 in dividends (Wallace Miner, Jan. 13, 1965, p. 3). How much of this amount was paid to Idaho residents was not determined;however, it is believed that a sizable portion of these funds benefit the local economy.

Twenty years ago nonmetallic minerals accounted for nearly ten percent

of Idaho's mineral output but today they account for approximately thirty percent of the state's total mineral production (Wallace Miner, Sept. 30, 1965, p. 2). The major cause for this increase has been expansion in the sand, gravel, and phosphate industries. Approximately sixty percent of the nation's economically recoverable phosphate reserves were reported to be in the western United States, until North Carolina started developing new reserves. Reserves in the western field are now estimated at forty-two percent of the nation's total, of which the best grade as well as the largest quantity are within Idaho's boundaries (Beall and Merritt, 1966, pp. 80-81). Economic growth in the phosphate industry can be expected as the need for phosphate increases.

Increasing uses of phosphate fertilizers for agricultural needs promises to provide markets for more phosphate rock. Elemental phosphorous and phosphoric acid uses are also increasing in the making of inorganic and organic chemicals, detergents, water softeners, and other consumer and industrial uses (Petersen, 1964, p. 19).

COMPOSITION OF INDUSTRY

Mining is a risk venture which requires large amounts of capital to explore, develop, and bring a mine into production. Economic conditions must then be right in order to sell the product at a profit. For instance, some mining companies in the Coeur d'Alene district are presently spending about four million dollars to sink a shaft and develop a mine. All of this expense is incurred without being certain that ore exists, or if it does exist, whether it can be mined and sold at a profit.

Entry into the mining industry requires large amounts of capital; therefore, the small operator under present conditions is almost excluded. True, the small operator may prospect and discover, but to develop a mine, he must generally turn to some large company. Capital requirements thus act as a deterrent to entry into the minerals industry. Established firms in an industry generally enjoy "absolute-cost" advantages, a situation whereby costs are relatively lower than for a new entrant into the industry. This "absolute-cost" advantage also pertains to the cost of raising large amounts of capital. Established firms can generally raise funds at a lower cost than newly entering or newly established firms; hence, capital costs may act as a barrier to the new or small firm. Consequently, the mining industry in Idaho is composed of a few major producers who have been able to survive under often adverse economic conditions. In fact, ninety-five percent of the state's base- and precious-metal production in 1965 came from nineteen producers in Shoshone County (Collins, Knostman and Petersen, 1965, p. 276).

The current trend among phosphate firms is toward an integrated operation which combines mining and processing either within one company or as a joint venture of two or more companies. This type of operation also involves large expenditures of capital for plant and equipment. In fact, plant investment in Idaho's phosphate industry was estimated at more than 100 million dollars

in 1966 (Sheperd, 1966, p. 37). According to one source, for every dollar invested in a new integrated operation, sixty cents goes for the chemical complex and forty cents for the land, mine, and ore dressing plants (Beall and Merritt, 1966, p. 85). Therefore, cost of processing capital may also be a barrier to entry into mining and/or processing in the phosphate industry.

Entry into the minerals industry initially requires some right to a mineral deposit, either by location, purchase, or lease. Secondly, large amounts of capital are required to develop these resources so that production can begin. Finally, the commodity must be marketed at a profit under existing conditions if the company or firm hopes to continue operations.

TRANSPORTATION

Idaho major mineral products are regarded as a low-unit value, high-bulk commodity; consequently, transportation charges impose some limitations on shipping to distant markets. Most of the processors of lead, zinc, and phosphate are located relatively close to the point of production to reduce transportation costs. For instance, 1963 freight rates on lead ore and concentrates which did not exceed $60.00 per ton in value from Burke, Idaho, to the lead smelter at Kellogg, Idaho, were $0.86 per ton, while ore of the same value shipped to East Helena, Montana, was charged $8.14 per ton (Knostman and Kingston, 1966, p. 111). Even the finished products such as slab zinc face a competitive loss in relation to producers in other areas. Shipments of slab zinc from East St. Louis, Illinois, to Chicago were charged $3.70 per ton, while similar shipments from Kellogg, Idaho, to Chicago, Illinois, were charged $19.02 per ton (Knostman and Kingston, 1966, p. 26). To offset these shipping charges on the bulk concentrate, most processors locate close to the source of mineral supply and then ship only the finished or semifinished products to market, thereby defraying some of the transportation costs.

Transportation charges are an important factor in the marketing of Idaho's mineral products since most of the major manufacturing areas are located at considerable distances from Idaho mines. Therefore, any savings in transportation charges place Idaho producers in a more competitive position with other suppliers.

EMPLOYMENT

Table I shows that the number of employees engaged in metal mining has gradually declined over the last ten years. During the same period, however, the number employed in other minerals industries has increased. Two areas of special importance in employment growth are the phosphate industry and the sand, gravel, and stone industry. Increased road construction in the state has caused employment to expand in sand, gravel, and stone related industries.

TABLE I
EMPLOYMENT, 1955 TO 1965*

Year	Mining		Manufacturing	
	Metals	Nonmetals	Stone & Clay Products	Phosphate
1955	4,112	297	427	797
1956	4,498	268	458	861
1957	4,388	249	451	880
1958	3,633	259	579	787
1959	3,305	292	664	1,139**
1960	2,282	235	654	1,244
1961	3,032	288	677	1,250
1962	2,996	270	686	1,254
1963	2,926	285	823	1,217
1964	2,951	327	757	1,106
1965	2,951	540	854	1,245

* Bureau of Mines Minerals Yearbook, Dept. of the Interior, U. S. Gov't. Printing Office, Washington, D. C.: 1956-1965.
** Due partly to better reporting methods.

Annual average employment in the minerals industry is listed in Table II. It can be seen that average employment has remained relatively stable while both payroll and production figures have been increasing. Most of these increases are due to both rising hourly wages and metal prices. In general, the minerals industry provides relatively stable year-round employment.

TABLE II
EMPLOYMENT, WAGES AND PRODUCTION, 1955 TO 1965*

Year	Annual Average Employment	Annual Payroll (Thousands)	Mineral Production (Thousands)
1955	6,781	$32,528	$68,513
1956	7,284	37,417	75,152
1957	7,221	38,653	73,464
1958	6,318	33,381	64,648
1959	6,558	35,617	70,209
1960	4,969	29,259	57,441
1961	6,257	36,867	68,900
1962	6,176	36,555	82,614
1963	6,235	37,658	82,755
1964	6,187	38,942	86,262
1965	6,870	44,491	105,085

* Bureau of Mines Minerals Yearbook, Dept. of the Interior, U. S. Gov't. Printing Office, Washington, D. C.: 1956-1965.

The annual average labor force in Idaho for 1965 was 271,600 available personnel (Idaho Employment Security Agency, Boise, Idaho). Of this total, 6,870 were employed by the minerals industry. Thus, only 2.5 percent of Idaho's employees were responsible for producing $105,085,000 worth of output. In terms of employment, the minerals industry seems rather insignificant--yet it is the third largest industry in Idaho in value of products.

METAL PRICES

As a basic industry, minerals firms must adapt to external market prices. This fact is partly true for the phosphate industry since prices are generally established by the grade of the ore and in relation to the lower-cost Florida producers (Beall and Merritt, 1966, p. 92). Metal prices are usually competitively established in a world or national market, particularly, on the London Metal Exchange and the New York Commodity Exchange. Idaho's minerals industry must adjust output, and hence costs, to these external or export markets in order to survive. Consequently, changing market prices can, and do, cause recessions and/or growth in the minerals industry. Recession or growth in the minerals industry is in turn transmitted to the local economy and reflected in growth or recession of the facilitating industries.

THE PRODUCT FLOW TABLE

A modified product flow table was used to summarize the data obtained in this study. This table incorporates some features of a purely descriptive product flow and some characteristics of a more detailed input-output analysis. A sales-dollar approach in accounting for transactions is common to both methods. Input-output analysis generally involves greater detail in accounting for direct and indirect transactions than was possible in this project. However, this study does show transactions with the major industry groupings. Much emphasis has recently been placed upon the various input-output studies of state and national economies. An input-output analysis seeks to define the interrelatedness among different segments of an economy, and to show these relationships through an input-output matrix.

The modified product flow table used in this study adopts the input-output presentation on a regional basis. That is, the State of Idaho is defined as a region for purposes of study, and one particular industry, the minerals industry, is shown in its relation to the other segments of the state's economy. Input-output methodology was also used in arranging sectors in the table.

Essentially, the table summarizes data in a systematic manner for easy presentation. Sales (output) from any sector listed at the left of the table are read horizontally across the table. Purchases (inputs) by industries listed at the top of the table are read vertically down the columns. Moreover, the table is constructed so that inputs are equal to outputs for each industry. Inputs must be equal to outputs in order to have a balanced table; furthermore, it is reasonable to expect that an industry cannot continually produce products without taking in some supplies and labor. The table contains three main parts:

1. Processing Sectors are defined as industries that produce the goods and process the materials. In this study, the processing sectors depict those firms that produce and process mineral products. Since most of the metal production is as a joint product, these separate outputs are allocated a portion of the transactions as described under the heading, "Selection and Grouping of Sectors," on Page 16.

2. Final Demand Sectors purchase or consume the final product from the processing sectors. For a basic industry most outputs are sold to an export market. Final demand also includes consumption, investment, and government purchases, but for mining firms export sales account for most activity in this sector.

3. Payments Sectors provide goods and services to the processing sectors and in turn receive payments in dollars from processing industries. As a group these sectors facilitate the processing industries.

Table III shows the mineral industry as the sectors are defined in this study.

TABLE III
PRODUCT FLOW TABLE

Dollar Value (thousands)

	Outputs[1] → / Inputs[2] ↓	Processing Sectors: Lead-Zinc	Silver	Copper	Phosphate	Other	Final Demand Sectors: Construction	Metal Fabricators	Lumber	Retail Wholesale	Exports	TOTALS
Processing Sectors	Lead-Zinc	$ 2,705	$ 539	$ 4	$ 180	$12		$352		$31	$87,100	$90,923
	Silver		492								22,734	23,226
	Copper							100			2,269	2,369
	Phosphate				7,865						75,607[a]	83,472
	Other						$6		$9	7	588[a]	610
Payments Sectors	Construction	124	67	3	825	6						1,025
	Metal Fabricators	95	3	2	320							420
	Lumber	2,839	703	30								
	Retail-Whlse.	7,895	2,317	115	5,760	27						16,115
	Services	9,917	2,148	61	10,505	188						22,819
	Capital Improvements	2,235	510		13,475	72						16,292
	Imports	24,568	4,468	157	6,500	47						35,740
	Payments to Government	2,103	1,426	92	678	7						4,306
	Households (labor)	16,815	9,476	740	12,015	218						39,264
	Value Added	21,626	1,077	1,165	25,349	33						49,250
	TOTALS	$90,923	$23,226	$2,369	$83,472	$610	$6	$452	$9	$38	$188,298	

[1]Sales (outputs) to industries listed at top of table from industries listed at left of table are read across the rows.

[2]Purchases by industries listed at top of table from industries listed at left of table are read down the columns.

[a]Estimated sales values

SOURCES OF INFORMATION

Information was obtained by using a one-page mail questionnaire which was sent to all of the major mining and mineral processing firms. (The questionnaire is shown as Table V) In 1965, the mining and minerals industry consisted of about twelve major producers. Other smaller firms contributed a minor amount to total production. Roughly eighty-three percent of the questionnaires were returned with usable information. Fourteen questionnaires were sent to smaller firms engaged primarily in sand, gravel, and stone products, but only two returns with limited information were received. Therefore, this sector was not included due to inadequate data.

Additional information was also obtained from U. S. Bureau of Mines publications, Idaho Bureau of Mines publications, Annual Reports of Idaho's Mining Industry, magazines, and newspapers. Annual reports supplied by each of the firms included in the study provided much usable data. Most of the firms involved in supplying information were cooperative.

SELECTION AND GROUPING OF SECTORS

Sectors included in the study were minimized to obtain information more easily. Since much of the data were not immediately available and had to be estimated, better results were obtained by using a smaller number of sectors; yet, detail was not sacrificed. Moreover, some aggregation of industries was necessary so that individual producers were not identified.

A special problem in tracing flows was involved in the metals industry where most of the products of lead, zinc, copper, silver, and gold are mined as more or less joint products. Transactions (i. e., sales and purchases) are not individually identifiable with each of the separate products; hence, some means had to be designed to allocate a portion of each transaction to a separate product. Accounting for joint products has been treated in several ways to allocate a portion of a firm's transactions to a product. Horngren gives two basic approaches -- (1) physical measures, and (2) relative sales values (Horngren, 1962, pp. 446-448). Consequently, the quantity of output for a producer of a joint product was treated in the following manner. The quantity of production for each firm's separate products was multiplied by an average price for 1965 as quoted in the Engineering and Mining Journal of February, 1966, and then that total was discounted by a percentage. This procedure was used because a smelter does not pay full assayed value for the ore concentrates but deducts a percentage for various processing and handling charges. In this manner the total sales volume for each firm was allocated to the separate products. Each product was then calculated as a ratio of the firm's total sales and this ratio was used to allocate a portion of the firm's transactions with other industries to each product. This pattern followed for the products lead-zinc, silver, and copper, for each firm, and these results were aggregated to obtain the industry totals shown in Table III.

PROCESSING SECTORS

In the product-flow analysis, processing sectors are included in the upper left-hand corner of the table. In Table III, firms in the processing sector occupy the first five places both vertically and horizontally. Sales and purchases between the processing industries can be seen to be relatively small. Most sales are to export markets and most purchases are from the payments sector.

Lead and Zinc

Composition of Industry.

With the exception of a few small firms almost all lead and zinc produced in the state comes from the Coeur d'Alene mining district. The Bureau of Mines survey states ninety-five percent of the base- and precious-metals production comes from this district (Collins, Knostman and Petersen, 1965, p. 16). Lead and zinc are mined as a joint product along with other metals, thereby leading to the problem of identifying a portion of the transactions with these metals. (See page 16). The industry is composed of a few large producers and several small producers, as well as the lead smelter and zinc plant.

Inputs.

Because of the lead smelter and zinc plant location within the state, ore concentrates are purchased for further processing into a refined marketable product. Some ore concentrates are bought locally and some from points in the Northwest and Canada. The Wallace Miner, on November 18, 1965, listed eighteen concentrate shippers to the Bunker Hill plants. Concentrate purchases by Bunker Hill provide a local market for producers and thus defrays transportation charges. Imported concentrates provide "feed" for Bunker Hill plants; hence, plant facilities can operate continuously, thereby providing stable employment for workers and economic benefits to the community.

Imports provide the greatest dollar volume of inputs into the industry. Imports include not only the value of purchased ore concentrates from outside the state but also the portion of goods and services in each of the payments sectors that are bought outside the state. For instance, a portion of purchases from retail-wholesale, services, and capital improvements are purchased outside the state; these purchases were included in the import sector.

The greatest single item of input into this industry is the purchase of labor. As such, wages amounted to $16,815,000 and were the greatest single cost item for this industry. In this respect, the lead-zinc industry is important to Idaho's economy because it provides direct employment for

workers. Not measured in this study are the indirect benefits of employment and output to other industries such as transportation and the services of other facilitating industries.

Outputs.

Bunker Hill production of refined lead during 1961 amounted to almost twenty-four percent of domestic lead production in the United States. Most lead and zinc are marketed as export products. Zinc is sold in the Great Lakes area and eastern states, where it is used for automobile castings, and some is purchased by Bunker Hill's Seattle Plant. Lead is also sold to Great Lakes and eastern markets (Knostman and Kingston, 1966, pp. 27-28). Export sales bring dollars into the industry to provide funds for the purchase of goods and services from other industries. Most of Idaho's lead-zinc production is marketed through Bunker Hill facilities. However, some concentrates from other mines are sold as exports from the state.

Silver

Composition of Industry.

All of the silver mined in Idaho is produced as a joint product, and most of this metal comes from the Coeur d'Alene district. Transactions were treated similar to the explanation for joint products on page 17 to arrive at an industry portion for each transaction. A few large well-established firms are the major producers; namely, the Sunshine Mining Company, Galena Mine, Hecla Mining Company, and the Bunker Hill Company.

Inputs.

Imports again included a combined amount of goods and services that come into Idaho rather than any one single import item. Wages, or the purchase of labor services, amounted to $9,476,000 and were the greatest single payment item for this industry.

Outputs.

Sales of silver amounted to $23,226,000 and were the greatest dollar value for any single mineral product in the state. Sales were either as silver concentrates or as bar silver to the export market.

Copper

Composition of Industry.

Several small Idaho producers contributed to the State's copper production, but again almost seventy percent of the total output was from the Coeur d'Alene district. Copper is obtained as a joint product with silver until separated by the refining operation into identifiable products. Therefore, transactions were

treated as they were in previous sections in order to isolate a portion that could be assigned to this industry.

Inputs.

Labor is the greatest single input into this industry while imports rank second. No capital improvements could be separately identified with this industry.

Outputs.

Copper is sold primarily as a concentrate to the export market due to the lack of refining facilities within the state. Some copper is also sold in a semifinished state to the export market. However, copper production is only a minor segment in the state's mineral production.

Phosphate Industry

Composition of Industry.

The phosphate industry is made up of both mining and processing firms, which are, for the most part, vertically integrated enterprises involved either directly or in partnership with another firm in the mining and processing of phosphate rock. Less that six large firms are presently operating in this industry, and they comprise the bulk of activity in phosphate mining and processing.

Inputs.

A considerable amount of phosphate rock is sold from mining firms to processing firms within the state. However, some of these sales are intra-company transactions and some are under partnerhsip arrangements in the mining operation. Although it is difficult to obtain information on these transactions as well as difficult to assign a value to transactions within the industry, interindustry sales of raw phosphate were approximately $7,865,000.

Capital improvements amounted to $13,475,000 and were the largest dollar input to the phosphate industry. The phosphate industry is in a period of expansion and capital creation figures therefore reflect this growth.

Labor is the next largest dollar volume of input for the phosphate industry; wages amounted to $12,015,000 for this group. The phosphate mining and processing firms are strongly labor-oriented and provide employemnt for many workers.

Services include the amounts paid for transportation, electricity, communication, water, and other related items. Since the phosphate industry, especially the elemental phosphorous portion, requires large amounts of electricity, purchases of these services is significant. One phosphate firm in Pocatello purchased $4,000,000 worth of labor and $6,000,000 worth of electricity as inputs during 1965, or three and one-half times as much electricity as

used by the city of Pocatello, Idaho (Idaho State Journal, Dec. 20, 1966, p.4).

Outputs.

Outputs of the phosphate industry were especially difficult to obtain since much of the export activities were captive sales and thereby not assigned a dollar value within the state. However, value was added to the finished product outside the state in the amount of the export. Therefore, these sales figures were calculated as explained in the following paragraph.

Total production of phosphate rock in Idaho during 1965 amounted to 3,700,000 long tons (Collins, Knostman and Petersen, 1965, p. 271). Assuming an average value at the mine of $5.76 per ton (Petersen, 1964, p. 19) this production was equivalent to roughly $12,000,000 worth of raw phosphate rock. Two different writers state that the value of total phosphate products, including phosphate fertilizer and elemental phosphorous, is four to five times the value of the raw rock (Hansen, 1965, p. 23). Since dollar volume could not be obtained, the value of production was quadrupled to obtain a total sales figure for all phosphate products. A factor of four was used as a conservative estimate, but a factor of five could have been employed. However, the resulting conservative sales figure of $83,472,000 was used in the analysis. At this amount, phosphate products compare quite favorably with the total value of lead, zinc, and silver production and/or sales in the state.

Other

Composition of Industry.

This sector includes only a small amount of information on clay products, and no data on other nonmetallic production in the state. Small producers comprise this group, and information was not obtainable from the majority of them. For the most part, output of firms in this sector includes metals such as gold and antimony, and nonmetals such as clay and clay products.

Inputs.

Labor and services constitute the major inputs for this grouping. Since information about these activites was quite limited, this sector contributes little to the total analysis.

Outputs.

Exports comprise the largest transaction for these miscellaneous firms. However, the total dollar value contributing to export markets is quite small relative to the other minerals industries.

FINAL DEMAND AND PAYMENTS SECTORS

Final demand and payments sectors represent the distribution of sales to

ultimate consumers and the amounts spent to purchase goods and services. Final demand entries, listed at the top right of the table, correspond to those industries and sectors that consume or use a good as a finished product, or use it in an intermediate step to produce some other end product. Exports are also included in this study since they represent a final sale of the product. Payments and services, are listed at the lower left of the table.

Construction

Final Demand.

Only a small amount of sales to construction firms as final users could be determined, primarily on the basis of one firm. If sand, gravel, and stone had been considered, the major portion of their sales could have been included in this sector.

Payments Sector.

Every industry in the processing sector purchased goods and/or services from construction firms and in return made payments to these industries. Some of the amounts spent for capital improvements could have been included in this grouping but because they could not be positively identified, they were combined with capital improvements.

Metal Fabricators

Final Demand.

Lead-zinc and copper industries are the only ones selling to metal fabricators in Idaho. These sales, mostly small, are to manufacturing firms for further processing.

Payments Sector.

Relatively small amounts of products were purchased from metal fabricators by each industry in the processing sector. These purchases were mainly from equipment manufacturing firms and job shops engaged in metal work.

Lumber

Final Demand.

Almost no sales were made to the lumber industry by the processing sector. Although a small amount of sales existed, they could not be identified with any specific industry.

Payments Sector.

Purchases from the lumber industry by the processing sectors are limited

almost exclusively to metal mining. Present metal mining methods require large amounts of timber and this transaction amounted to $2,572,000. Almost all of these timber purchases are restricted to the Coeur d'Alene mining district, although small amounts are also associated with central Idaho mining interests.

Retail-Wholesale

Final Demand.

Small amounts of mined products were sold to retail and wholesale outlets in the state. These sales were mostly lead, which is used for plumbing and other purposes, but some zinc and firebrick sales were also included.

Payments Sector.

All of the processing sectors purchased a total of $16,115,000 worth of goods and/or services from retail and wholesale outlets in the state. This grouping of retail and wholesale outlets is described as a facilitating industry. A facilitating industry derives its livelihood from those industries it serves; hence, the minerals industry actively supports the local and state economy in this manner.

Services

Final Demand.

No direct sales of Idaho mineral products to the services sector could be identified. All of the services industries are, however, dependent upon mineral producers since they must buy finished goods from import markets.

Payments Sector.

Purchases from the services industry amounted to $22, 819,000. This total included payments to industries that facilitate the minerals industry, such as electrical, transportation, communication, and legal services to name only a few. These funds provide employment and incomes for persons not actively engaged in the minerals industry. In this way, minerals industry firms help support the total state economy.

Capital Improvements

Payments Sector.

Some capital-improvement purchases were made by almost all industries with the greatest amount credited to the phosphate industry. Approximately $16,292,000 could be identified within the state as spent for capital improvements in plants and assets. Roughly twenty percent of the total imports are due to purchases from out-of-state construction firms for capital improvements. The greatest amount of capital improvements ($13,475,000) was in the rapidly expanding phosphate industry.

Imports

Payments Sector.

Imports include goods and services purchased from firms in other states and its value in this study represents dollars flowing out of Idaho. These purchases include ore concentrates, transportation, and other services as well as amounts spent for capital improvements. Some of these capital improvement funds will be returned to the state as construction workers' salaries and business related with building new facilities. Concentrate imports also provide "feed" to the smelter and zinc plant enabling them to operate continuously, thereby providing steady employment, and hence business dollars to the state's economy.

Exports

Final Demand.

Of the total mineral production in the state more than ninety percent finds its way to export markets where it is sold to bring dollars back into Idaho's economy. This money then flows through the minerals industry and into the economy in the form of wages as well as purchases of goods and services. Export sales amounted to about $188,298,000 during 1965. This figure more truly represents mineral industry activity since phosphate sales are included rather than just the value of mine production.

Payments to Government

Payments Sector.

Taxes represent payments to state, local and city governments to pay for the services they provide. Property taxes alone paid by the mining industry of Idaho during 1965 were estimated by one author at more than $3,5000,000 (Hansen, 1965, p. 23). This study indicated that more than $4,000,000 was paid in state, local, and city taxes by minerals industry firms. Federal income taxes were included in the value added entry rather than in this sector.

Households

Payments Sector.

This study shows that $39,264,000, or roughly twenty-one percent of the total export dollars ($188,298,000), were paid out to households in the form of wages, salaries, and benefits. According to the Bureau of Mines' data, wages and salaries in the minerals industries amounted to $44,491,000, while the value of total production was $105,085,000 (Collins, Knostman and Petersen, 1965, pp. 262 and 265). Using these figures, wages and salaries amounted to greater than forty-two percent of total production. This difference arises because exports count value added in processing and a realistic value for phosphate products, while Bureau of Mines' production figures represent only the

value of the initial raw phosphate rock. Bureau of Mines' data include sand and clay products as one group to which $5,210,000 were paid in wages. If this amount was added to the total derived from this study, the amount would be $44,474,000, which is reasonably close to the Bureau's figures.

Value Added

Payments Sector.

This sector is added to present a balanced table and thereby implies that total inputs equal total outputs for the region or industry being studied. As used in this study, value added includes such items as federal taxes, dividends, depreciation, profit, interest, and other entries that were difficult to obtain separately. To arrive at an aggregate figure for this entry, the sum of the total purchases column for each sector was subtracted from the total sales figure for that same sector. This figure was then used for the value added entry.

A value-added entry should not be taken to mean any one item such as identifying it solely with profits, since its function is mainly to adjust inputs to outputs for each sector. Some of the sales and purchases figures obtained for this study were only reasonable estimates; in this way, the value-added entry reflects these calculations.

Businesses in the payments sector received dollars from other firms to provide employment and to make additional purchases from their suppliers. Again, these indirect transactions were measured only as to the amount that would have to be purchased by a payment sector industry to satisfy the demand created by purchases of firms in the processing sectors.

Multiplier Effect

The value of production by a basic industry, as set forth in Keynesian economics, can and does have an important multiplier effect on the economy. This round of economic activity referred to as the multiplier effect is explained as follows: Export sales bring a typical dollar into the basic industry. From this dollar, a portion may be retained as profit, but the remainder flows into the economy in the form of purchases by other payment-sector industries. Payment-sector industries receive less than a full dollar, and of that portion they receive some is again retained as profit and the remainder flows into the economy in the form of purchases from industries to facilitate the payment-sector firms. Thus, it is apparent that an initial dollar coming into the economy through export sales by minerals industry firms causes the total value of purchases in the economy to be some multiple of that original dollar.

If the total dollar should be retained by the basic industry, either as profits or in some other form, no multiplier effect would be felt in the economy. The importance of a basic industry to an economy is that it supplies dollars to the community which are in turn spent and respent by each receiving firm. Indeed, this is the nature of economic activity in general.

TECHNICAL COEFFICIENTS

Input-output analysis uses a table of technical coefficients to express an industry's position in a market region. A technical coefficient is simply the ratio of a particular industry's purchases from one segment of the economy to that industry's total purchases. If an industry increases its total purchases by a certain dollar amount, that increase can be traced through the table to determine how each sector will be affected. Since this study uses a modified product flow similar to the input-output matrix, these coefficients were calculated for the minerals industry (See Table IV).

To explain further, by using silver as an example, the ratio of labor input to total purchases is a ratio of 9,476,000 to 23, 226,000, which is roughly forty-one percent. In other words, forty-one percent of the purchases by the silver industry were from households in the form of wages and salaries. Now at a projected annual rate of growth of four percent, silver output will increase roughly $930,000. This growth in output will require purchases to increase as follows: Purchases from the lead-zinc industry would increase by $21,400 ($930,000 x 0.023), from the silver industry $19,600 ($930,000 x 0.021), from the construction industry $2,600 ($930,000 x 0.003), and from households $375,000 ($930,000 x 0.407). Each entry in the column can be computed in a similar manner to find the direct requirements from each industry to meet the increased demand. Indirect requirements will then be needed by each of the industries to meet the increased

purchases by the silver industry. Some change in these coefficients will be expected since they are not completely fixed; however, in the short-run, they remain relatively constant enough to be useful for predicting industry changes.

ECONOMIC GROWTH

Economic growth is concerned with an increase in the ability of a political unit to provide the material means for satisfying individual or collective desires for various goods and services. Therefore, for economic growth to occur, at least two factors must be present: (1) an increasing population with the necessary capital and the desire for goods and services, and (2) the resources or material means coupled with the technological advances necessary to supply those needs. The world population explosion, estimated at 3,626,000,000 by 1970, will require economic growth in the form of capital accumulation and increasing real output. Increases in technology and higher Government priorities in certain areas will also stimulate economic growth. All of these activities will undoubtedly involve a rising demand for metals and mineral products.

Idaho's minerals industry is in a position to increase its output and take advantage of increased demands. But increased production in the minerals industry generally takes several years of preparation to provide the plant and equipment necessary for any increased output. One survey reveals that once and ore body has been discovered, all conditions must be near-optimum in order to bring a mine into production in less than two years (Peters, 1966, pp. 63-64). The pre-production interval ranges from one to seven years, or longer, depending upon the type of ore and method of mining.

Minerals and metals are the basic structural materials of a mechanized economy such as the United States now enjoys. A continued mineral supply is necessary to function on the present scale. Forecasted mineral needs show that production must increase in order to supply imminent demand. Some of these projected needs are:

(1) an eighteen percent increase in Free World silver usage by the end of 1968, over the 1963 level (Hardy, 1965, p. 63).

(2) an annual rate of growth for total ferilizer consumption of eight percent from 1964 to 1970 (Davan and Houseman, 1965, p. 88).

(3) an annual rate of growth for real Gross National Product (called "GNP), from four to four and one-half percent from 1966 to 1970 (Joint Economic Committee, 89th Congress, 2nd Session; U. S. Economic growth to 1975 - potentials and problems).

(4) an increase of three times the present mineral supply will be needed to operate on the projected level thirty-five years from now (Romney, 1965).

Almost every study of mineral requirements is based on Gross National Product which is based on population growth multiplied by buying power. Projected population figures then become important as well as per capita consumption, or buying power. Therefore, any increase in Gross National Product can be expected to increase the need for mineral products.

SUMMARY AND CONCLUSIONS

The purpose of this study was to analyze Idaho's minerals industry and to determine the interrelationships among these firms and the state's total economy. A sales-dollar approach was used since most firms maintain data, and often release them, in terms of sales dollars.

Results of the study are summarized in the product flow table (No. III). Most minerals industry products flow out of state to export markets and return dollars to the state. Nearly all of the payments sectors included in the study depict the contribution of goods and services to each processing industry which, in turn, receive a dollar flow from the minerals industry.

Labor contributes the greatest single input to the minerals industry while exports constitute the greatest single output. A sizable portion is paid to Idaho's economy directly in the form of taxes. Although total employment of labor in the minerals industry itself is not large, supporting industries are directly supplied with funds by minerals firms which, in turn, provides other types of employment. Total direct and indirect transactions of the minerals industry make a sizable contribution to Idaho's economy. From this preliminary research, the following conclusions can be drawn:

(1) The minerals industry is strongly labor oriented because human resources are the greatest single input for each of the processing sectors. For example, wages and salaries amounted to $39,264,000 in 1965.

(2) The minerals industry is a basic industry because it sells to markets outside Idaho and thereby brings dollars into the state's economy. In this regard, export sales amounted to approximately $188,298,000 in 1965.

(3) The minerals industry supplies tax dollars to support state and local govenment. In fact, $4,306,000 in taxes were paid during 1965.

(4) The minerals industry buys from facilitating firms and thereby supports indirect employment and other industries. To illustrate, in 1965, purchases from retail-wholesale, services, and capital improvements amounted to $55, 226,000.

(5) Expansion of mining and processing firms, or attraction of new mineral processing firms into the state would increase the economic benefits derived from minerals industry firms.

Since many of the data were estimates, a complete reliance upon the figures is not warranted. However, this study indicates general trends and interrelationships among the industries that could only be conjectured previously. Findings from this research suggests the minerals industry to be one of the channels that brings dollars into Idaho's economy and then distributes them to other sectors of the economy.

TABLE V
IDAHO MINERAL INDUSTRY QUESTIONNAIRE

If exact percentages are not available reasonable estimates will be acceptable.

1. Please list the products sold by your firm during 1965:

_____

_____

2. Average number of full-time employees during 1965? _____

3. Total amount of wages and salaries during 1965? $_____

4. Amount spent for capital improvements during 1965 (building--including labor, equipment, or other, with life longer than one year)? $_____
   a. Percentage purchased by your firm directly from within Idaho? _____%
   b. Percentage purchased by your firm directly from out of Idaho? _____%

5. Total gross sales of products during 1965? $_____
   a. Percentage of sales by your firm directly within Idaho? _____%
   b. Percentage of sales by your firm directly outside Idaho? _____%

6. Amount of taxes paid by your firm during 1965, in support of Idaho's economy?
   a. State Income Taxes? $_____
   b. Idaho Property Taxes? $_____
   $_____

7. Total gross purchases during 1965, by your firm? $_____
   a. Percentage purchased within the State? _____%
   b. Percentage purchased outside the State? _____%

8. a. How would you divide the amount of sales by your firm in item (5) above among the industries listed below?
   b. How would you divide the amount of purchases by your firm in item (7) above among the industries listed below?

Please omit those industries that were not sold to or purchased from during the year.

Type of Industry:	Percentage of Sales directly to the following industries		Percentage of Puchases directly from the following industries	
	IN STATE	OUT OF STATE	IN STATE	OUT OF STATE
Lead and Zinc	_____%	_____%	_____%	_____%
Copper	_____%	_____%	_____%	_____%
Silver	_____%	_____%	_____%	_____%
Phosphate	_____%	_____%	_____%	_____%
Sand, Gravel, and Stone	_____%	_____%	_____%	_____%
Agriculture	_____%	_____%	_____%	_____%
Construction	_____%	_____%	_____%	_____%
Mineral Processors	_____%	_____%	_____%	_____%
Metal Fabricators	_____%	_____%	_____%	_____%
Lumber	_____%	_____%	_____%	_____%
Retail and Wholesale (mine supplies, or other sales and purchases)	_____%	_____%	_____%	_____%
Services (legal, utilities, communication)	_____%	_____%	_____%	_____%
Other: _____	_____%	_____%	_____%	_____%
_____	_____%	_____%	_____%	_____%
Totals should equal 100%	_____%+	_____% = 100%	_____%+	_____% = 100%

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