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SFMRB

Surface Finishing Market Research Board

METAL FINISHING INDUSTRY MARKET SURVEY

1997–1998

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Metal Finishing
Suppliers' Association

NAMF

National Association of
Metal Finishers

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1997-1998

This report is published under the auspices of the Surface Finishing Industry Council (SFIC) by the American Electroplaters and Surface Finishers Society (AESF), the Metal Finishing Suppliers' Association (MFSA), and the National Association of Metal Finishers (NAMF) as a service to the metal finishing industry and contains information based on input from companies in the industry. The information published in this report was developed from actual historical information, and does not include any quantitative projected information.

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EXECUTIVE SUMMARY

In recognition of the need for statistical information on the metal finishing industry and under the auspices of the Surface Finishing Industry Council (SFIC), the American Electroplaters and Surface Finishers Society (AESF), the Metal Finishing Suppliers' Association (MFSA), and the National Association for Metal Finishers (NAMF) jointly support the Surface Finishing Market Research Board (SFMRB). The board is composed of representatives of the sponsoring organizations, who meet to discuss methods to gather the data of interest, implement these methods, and then compile and report results.

This report is the fourth in a series. The initial report was completed in March of 1994, with subsequent reports in June 1995 and June 1997. This report confirms and updates much of the previous data and also provides information on computer usage, quality control practices, and bath life extension.

Some of the key findings, which are further detailed in the text, tables, and figures of the report, were as follows:

- 1997 was a better business year for most finishers as nearly 70% reported year-to-year sales revenue increases. An even more optimistic future is forecast with 80% of job shops anticipating increases in 1998 and 90% expecting long term revenue increases.
- Job shop finishers spent an average of $120,000 for capital expenditures in 1997.
- Expanded job shop operating costs are reported with an average margin of nearly 16% margin before profit, depreciation, and interest.
- The average job shop has 2.5 regulatory-compliance related employees, costing 2.1% of sales revenue. These employees cost 20% more than the average employee. In addition, environmental services and materials cost job shops 3.3% of sales revenue on the average.
- Over 95% of finishers use computers with 70% having Internet access and 70% with CD-ROM capability.
- The two primary Internet uses by finishers were for E-mail and product information requests, with 80% using the Internet at least two times per week.
- ISO 9000 is the most common quality control program among finishers with 50% of captive shops and nearly 10% of job shops currently certified.
- Filtration is by far the most common method used for extending the life and/or improving the performance of finishing process solutions.
- Approximately half of the responders were members of either AESF or NAMF. NAMF members tend to be the larger job shops with annual sales revenues of $3.7 million.

For the first time, SFMRB is offering customized analyses and reports of this data for a modest fee. A complete regional report (e.g., New England) or a focused national report on one process (e.g. zinc plating) can be prepared.

PURPOSE OF SFMRB

The metal finishing industry in North America has been faced with dramatic economic, technical, and regulatory challenges in recent decades. An industry under diverse pressures needs basic statistical information to know where it stands and to guide its future course. The Surface Finishing Market Research Board (SFMRB) was created in 1991 to meet this need.

SFMRB is sponsored by the Surface Finishing Industry Council (SFIC), which in turn is jointly funded and supported by the American Electroplaters and Surface Finishers Society (AESF), the Metal Finishing Suppliers' Association (MFSA), and the National Association of Metal Finishers (NAMF). The first two SFMRB reports, completed in 1994 and 1995, focused mainly on the status of the electroplating portion of the metal finishing industry. The third SFMRB report, completed in 1997, once again reported on the industry status, but also included data on six special areas of high interest to the sponsoring members.

The information in these reports helps both metal finishers and their suppliers make better decisions regarding areas for business development and provides the industry with more detailed information regarding employment and commercial activity for use in presentation to governmental and regulatory bodies.

This report was prepared to update the previous studies and to explore some new areas of special interest to the industry.

PREFERENCE SURVEY

In the Spring of 1996 a preference survey was conducted to determine the areas of interest of members of the sponsoring organizations (AESF, MFSA, and NAMF) regarding topics to be investigated by the SFMRB. Some of the topics had been addressed in the past and were considered of continued interest including:

- Economic outlook for finishers
- Cost of compliance with environmental and safety regulations
- Finishing processes in use
- Industries served by finishers.

Areas of special interest, covered in the 1996-1997 report, included:

- Approaches to zero discharge (resource recovery)
- Substitutes for chromium and cyanide
- Cleaning and pretreatment practices.

The SFMRB met in June of 1997, during SUR/FIN in Detroit, to set plans for 1997-1998. It was decided to address two other areas from the Preference Survey, in addition to an economic update, and other items of continuing interest. New areas included in this report are:

- Methods for increasing performance and extending the life of process solutions
- Use of quality assurance tools.

In addition, more extensive data on the cost of operating a finishing facility would be gathered and the usage of computers in finishing shops would be addressed. Attempts would also be made to set up a database of the information to permit more detailed information to be derived.

METHODOLOGY

Mailing lists supplied by a single industry trade publication (Products Finishing), which also offered to handle the mailing, printing, and collection of returns at minimal expense to the SFMRB were used. The lists were provided without rental charge. A random selection was made from the particular lists of interest for each topic area. The lists generally consisted of only captive and job shop finishers in the United States who conducted the operations concerned in the survey questions. Questionnaires were designed to be anonymous, brief, and easy to fill out. Each questionnaire was sent with a strong covering letter and a dollar bill to further encourage participation.

SURVEY RESPONSES

Two separate surveys were conducted.

Survey #1. This was mailed in the fall of 1997 to 2,000 U.S. captive and job shops engaged in metal finishing operations. It posed questions related to sales, employment, cost of operations, markets served, processes and equipment employed, and the economic outlook for 1998.

Survey #2. This was sent in early winter of 1998 to 2,000 U.S. captive and job shops engaged in metal finishing operations. It posed questions related to computer usage in finishing, quality assurance practices, and methods employed for extending the life and/or im proving the performance of cleaning/pretreatment solutions, plating and anodizing baths, and conversion coating solutions.

The response rate for each survey is summarized in Table 1. The response rates for both of the current surveys were excellent.

A comparison of the two recent responses with past surveys is shown in Table 2. One disappointment involved the low captive shop response rate for survey #1, where only 61 forms were returned. As a result, some of the captive shop data is statistically insignificant and has, therefore, resulted in only a limited amount of reported data.

Table 1 Survey Responses

	Fall 1997	**Winter 1998**
List Size	7938	8429
Number Mailed	2000	2000
Usable Returns	511	416
Response Rate	**25.5%**	**20.8%**

Table 2 Comparison of Facility Types Responding to Surveys

Survey	**Captive Shops**	**Job Shops**
1992-1993	32%	68%
1993-1994	22%	78%
1996-1997	53.4%	46.6%
Fall 1997	**11.9%**	**88.1%**
Winter 1998	**47.2%**	**52.8%**

BASIC INFORMATION

Plant Locations

Figure 1 shows the eight areas used to group the responses geographically. Tables 3 and 4 display all responses and the job shop responses, respectively, broken down by percentage of plant sites in each of the eight U.S. regional areas with comparisons to the previous survey. The distribution compared favorably, except that there was a larger number of plants located in the Western region. This is considered as more representative data, since the Western region was believed to be previously under-reported. The current SFMRB survey confirms that the Midwest is the largest area, with about 40% of all finishers located in either the East or West Central regions.

Employment

Employment levels for job shops and captive shops are summarized in Tables 5 and 6. The data indicate a median of 23 and an average of 40 job shop employees per facility. There is a median of 18 and an average of 48 captive employees per facility.

The median here and in subsequent tables is taken as the number of employees for the shop in the middle of the group, for example, the third shop in a ranked list of five; while the average is the sum of all employees for all shops divided by the number of shops. Since values were tabulated as ranges of numbers the averages in this case and in subsequent tables were calculated as follows.

Figure 1 Geographical Regions for Tables 3 & 4

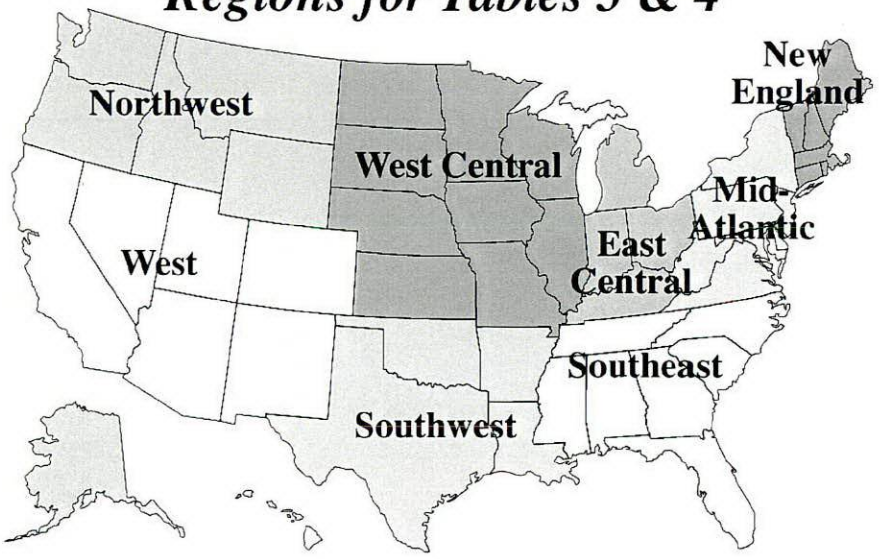


Table 3 Plant Locations of Respondents

Region	1996-1997	Fall 1997	Winter 1998
New England	7.6%	9.8%	9.4%
Mid-Atlantic	15.6%	13.3%	16.2%
Southeast	10.1%	7.3%	12.4%
East Central	22.9%	20.3%	20.8%
West Central	23.4%	19.5%	18.5%
Southwest	4.5%	4.8%	5.6%
West	11.8%	21.2%	14.2%
Northwest	4.1%	3.9%	2.8%

Table 4 Job Shop Plant Locations

Region	1996-1997	Fall 1997	Winter 1998
New England	8.1%	10.4%	10.6%
Mid-Atlantic	13.5%	12.7%	16.9%
Southeast	8.7%	6.4%	7.2%
East Central	26.0%	20.5%	22.2%
West Central	21.6%	19.8%	18.4%
Southwest	1.6%	4.7%	5.3%
West	15.1%	21.4%	16.4%
Northwest	5.4%	4.0%	2.9%

Table 5 Number of Job Shop Employees

Range	1996-1997	Fall 1997	Winter 1998
1-5	25.4%	13.6%	12.7%
6-10	*	14.7%	10.8%
11-20	12.7%	17.8%	16.0%
21-30	16.4%	12.7%	14.6%
31-50	18.0%	16.7%	16.0%
51-75	7.4%	9.4%	11.7%
76-100	6.9%	6.7%	5.6%
101-200	10.6%	7.5%	8.6%
>200	2.6%	1.1%	4.2%

* Included above

Table 6 Number of Captive Shop Employees

Range	1996-1997	Fall 1997	Winter 1998
1-5	33.2%	19.7%	22.2%
6-10	*	16.4%	13.9%
11-20	19.8%	21.3%	13.4%
21-30	12.0%	6.6%	9.8%
31-50	9.2%	4.9%	6.7%
51-75	7.8%	11.5%	5.2%
76-100	6.0%	6.6%	8.8%
101-200	6.0%	6.6%	8.2%
>200	6.0%	6.6%	11.9%

* Included above

The midpoint of each range was multiplied by the percentage of data in that range. The midpoint of the highest range, designated as more than a certain figure, was selected as being the same amount above the midpoint of the prior range. The sum of each calculation yields the average.
For example, with the following set of values:

<3 - 20%
3-5 - 30%
5-8 - 40%
>8 - 10%

The average = 1.5 x 0.2 + 4 x 0.3 + 6.5 x 0.4 + 9.5 x 0.1 = 5.05

In the last survey, job shops were indicated to have a median of 28 and an average of 48 employees per facility with captive shops having a median of 19 and an average or 46. The lower median values relative to the averages, illustrates the larger concentration of small U.S. metal finishers who have 10 or fewer employees. It is clear that the current survey included a much greater participation from smaller firms.

Facility Size

The floor space of responding job and captive shop facilities is compared to the last survey in Tables 7 and 8. The current survey indicates that the median job shop operation is approximately 16,500 square feet versus 19,000 in the last survey with an average of 27,000 square feet vs 33,000 in the last survey. The median captive shop has 9,500 square feet versus 18,000 in the last survey and an average of 29,400 square feet versus 27,000 in the last survey. The low median sizes, compared to the averages, is further confirmation of the presence of a large number of small metal finishing shops.

Table 7 Job Shop Floor Space

1,000 sq. ft.	1996-1997	Fall 1997
<5	29.4%	12.5%
5-9.9	*	21.0%
10-19.9	26.7%	24.8%
20-29.9	11.2%	13.4%
30-49.9	15.5%	13.0%
50-100	10.7%	11.8%
>100	6.5%	3.4%

*Included above

Table 8 Captive Shop Floor Space

1,000 sq. ft.	1996-1997	Fall 1997
<5	40.2%	30.0%
5-9.9	*	23.4%
10-19.9	23.3%	8.3%
20-29.9	14.0%	5.0%
30-49.9	10.3%	18.3%
50-100	6.1%	6.7%
>100	6.1%	8.3%

*Included above

Table 9 Industries Served by Job Shops

Industry Segment	Fall 1997	Last Year
Machinery/Industrial	44.0%	38.7%
Computer/Communications/ Electronics	36.1%	31.7%
Automotive/Truck-OEM	31.9%	37.6%
Automotive/Truck-Aftermarket	20.4%	19.9%
Fasteners	20.3%	NR
Defense/Military/Government	19.2%	18.3%
Civilian Aircraft/Aerospace	17.7%	11.8%
Hardware/Tools	14.5%	21.0%
Appliances	14.0%	10.8%
Medical	13.8%	<1.0%
Furniture/Fixtures	12.0%	12.9%
Building/Construction	11.4%	13.4%
Wire Goods/Pipe	8.2%	11.3%
Plumbing Fixtures	7.4%	NR
Sporting Goods/Toys	6.1%	5.4%
Jewelry/Watches	4.1%	5.9%

NR - not reported

Industries Served

Tables 9 and 10 list the industry segments served by job and captive shops compared to the last survey. Each respondent was asked to list their top three industry segments. The responses were then weighted to account for those who only mentioned one or two segments. The automotive, computer/electronics, machinery/industrial equipment, and defense/government continue to be the four largest segments served by all finishers. Fasteners are also a big segment for job shops. Year-to-year reductions were noted for job shops in the automotive and hardware segments, while increases were noted for appliance, aircraft, computer/electronics, and machinery. Captive shops showed significant yearly increases in the automotive, aircraft, computer/electronics, furniture, hardware, and medical segments. It is not surprising that if the two automotive segments (OEM and aftermarket) are combined they would be the most dominant segment for all finishers, which is consistent with past surveys.

Table 10 Industries Served by Captive Shops

Industry Segment	Fall 1997	Last Year
Automotive/Truck-Aftermarket	41.1%	16.1%
Computer/Communication/ Electronics	39.8%	23.5%
Machinery/Industrial	27.1%	26.7%
Defense/Military/Government	26.3%	23.0%
Automotive/Truck-OEM	25.0%	21.2%
Civilian Aircraft/Aerospace	22.5%	16.6%
Hardware/Tools	15.3%	12.4%
Furniture/Fixtures	14.4%	7.4%
Appliances	13.6%	10.1%
Medical	12.7%	5.5%
Fasteners	11.0%	NR
Building/Construction	10.2%	11.0%
Plumbing Fixtures	9.3%	NR
Sporting Goods/Toys	4.2%	3.7%
Wire Goods/Pipe	2.5%	6.0%
Jewelry/Watches	<1.0%	1.4%

NR - not reported

Processes Employed

The significant processes employed by both captive and job shops are shown in Tables 11 through 16. The percentage figures in these tables are based on the total responses and do not add up to 100% as most respondents are engaged in several different process operations.

Tables 11 and 12 list electroplating processes used in job and captive shops and provide comparisons to the last survey. It is not surprising that nickel, copper, and zinc are the leading processes employed. Data and comparisons for job shops are shown for electroless plating and anodizing processes in Tables 13 and 14 . Electroless nickel as the dominant process is not surprising, but the 137 job shops employing anodizing does seem high.

Data for the most commonly used other finishing operations are shown in Tables 15 and 16 for job and captive shops. There are some differences in other processes employed between this and the past survey (e.g., the larger reported job shop bright dipping and the smaller amount of captive shop blackening and electropolishing.) Significant process use trends will become evident when data over a more extended three-to-five year period can be compared.

Table 11 Electroplating Processes Used in Job Shops

Process	Fall 1997	Last Year
Nickel	56.0%	54.1%
Copper	46.7%	40.9%
Zinc	39.6%	30.9%
Chromium (Dec.)	28.7%	23.8%
Tin	28.4%	22.7%
Gold	23.6%	23.3%
Silver	23.6%	21.5%
Chromium (Hard)	18.9%	17.1%
Brass	17.8%	14.4%
Cadmium	16.7%	13.3%
Tin-Lead	10.9%	9.4%
Zinc Alloys	8.7%	5.0%
Nickel Alloys	5.8%	5.5%
Rhodium	4.2%	3.3%
Palladium & Alloys	3.6%	5.5%
Bronze	2.7%	5.0%
Lead	2.7%	1.7%
Tin-Nickel	2.2%	2.8%
Platinum	1.3%	1.1%
Indium	<1.0%	<1.0%
Ruthenium	<1.0%	1.1%

Table 12 Electroplating Processes Used in Captive Shops

Process	Fall 1997	Last Year
Nickel	49.2%	42.0%
Chromium (Dec.)	27.9%	14.0%
Zinc	21.3%	26.0%
Tin	19.7%	14.5%
Chromium (Hard)	16.4%	9.7%
Copper	15.0%	25.6%
Tin-Lead	13.1%	8.2%
Brass	9.8%	10.1%
Cadmium	9.8%	5.8%
Silver	9.8%	11.0%
Gold	8.2%	15.0%
Nickel Alloys	8.2%	4.3%
Zinc Alloys	4.9%	3.9%
Lead	3.3%	2.9%
Indium	1.6%	<1.0%
Palladium & Alloys	1.6%	1.4%
Tin-Nickel	1.6%	2.9%
Bronze	<1.0%	2.9%
Platinum	<1.0%	2.4%
Rhodium	<1.0%	<1.0%
Ruthenium	<1.0%	<1.0%

Table 13 Electroless Plating Processes Used in Job Shops

Process	1996-1997	Fall 1997
Copper	3.3%	3.6%
Gold	2.8%	3.8%
Nickel	26.0%	33.1%
Palladium	1.7%	<1.0%
Silver	1.7%	1.3%
Tin	<1.0%	1.3%

Table 14 Anodizing Processes Used in Job Shops

Process	1996-1997	Fall 1997
Chromic Acid	3.9%	10.2%
Decorative	6.1%	Not reported
Hardcoat	6.1%	15.3%
Sulfuric Acid	Not reported	28.9%
Sulfuric/Boric	Not reported	2.4%

Table 15 Other Finishing Processes Used in Job Shops

Process	Fall 1997	Last Year
Metal Stripping	32.4%	37.0%
Bright Dipping	26.9%	15.5%
Blackening	21.3%	17.7%
Immersion Plating	15.3%	10.5%
Paint Stripping	14.4%	13.8%
Antiquing	12.7%	11.6%
Electro-polishing	10.9%	10.5%

Table 16 Other Finishing Processes Used in Captive Shops

Process	Fall 1997	Last Year
Metal Stripping	24.6%	28.5%
Immersion Plating	24.6%	2.4%
Bright Dipping	19.7%	19.8%
Paint Stripping	18.0%	20.8%
Antiquing	16.4%	7.7%
Blackening	9.8%	9.8%
Electro-polishing	6.6%	11.6%

Substrates

Table 17 shows the substrates processed by job shops. Each respondent was asked to list the three substrates most frequently processed. Responses were then weighted to account for those who listed only one or two. Nearly three-quarters of all job shops process low carbon steel and nearly half finish aluminum alloys. The aluminum substrate frequency seems surprisingly high; however, the result is supported by higher responses for some of the processes used with aluminum in Tables 15 and 16.

Equipment Employed

Tables 18 and 19 summarize the total number of plating and anodizing equipment lines used by job and captive shops responding to the survey. The average for job shops is 4.8 lines, while for captive shops the average is 3.1 lines. The data from these tables were used to prepare Figures 2 through 9.

The extent of automation for job and captive shops is shown in Figures 2 and 3. It is not surprising that there is more automation in captive operations, since their finishing requirements are more predictable.

Table 17 Substrates Processed in Job Shops

Material	Users
Low Carbon Steel	72.0%
Aluminum Alloys	44.9%
High Carbon Steel	38.8%
Stainless Steel	34.1%
Copper & Brass	33.4%
Zinc & White Metal	17.4%
Cast Iron	8.8%
Nickel Alloys	7.0%
Plastics	4.1%
Titanium Alloys	3.8%
Circuit Boards	2.3%
Ceramics	<1%
Others	1.4%

Table 18 Plating/Anodizing Equipment Used in Job Shops

Type	Rack	Barrel	Rack + Barrel
Hand Line	591	162	112
Manual Hoist	364	216	95
Automated Hoist	134	111	30
Automated Return	113	33	6

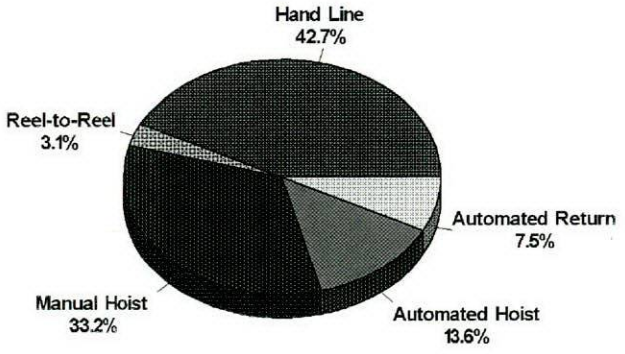
Basis: 424 responses; 62 reported reel-to-reel lines

Table 19 Plating/Anodizing Equipment Used in Captive Shops

Type	Rack	Barrel	Rack + Barrel
Hand Line	25	15	6
Manual Hoist	31	15	9
Automated Hoist	33	6	3
Automated Return	8	3	1

Basis: 53 responses; 10 reported reel-to-reel lines

Figure 2 Extent of Automation in Job Shops



There is a considerable similarity in the types of rack and barrel systems used by job and captive shops as shown in Figures 4 and 5. The higher degree of captive shop automation compared to job shops is again noticeable in Figures 6 and 7 where rack systems are compared. The barrel system comparison between job and captive shops in Figures 8 and 9 is hard to explain. It shows a reverse use pattern with more automation reported for job shops than captive shops.

Figure 3 Extent of Automation in Captive Shops

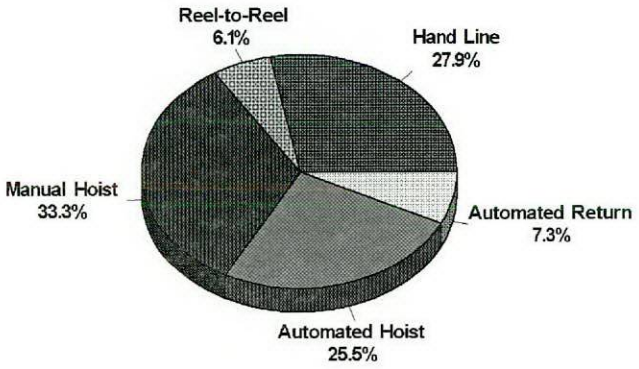


Figure 4 Types of Systems Used in Job Shops

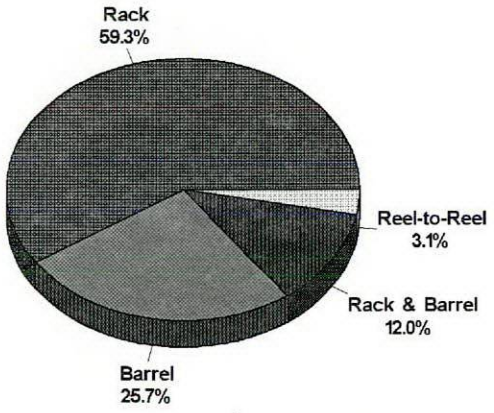


Figure 5 Types of Systems Used in Captive Shops

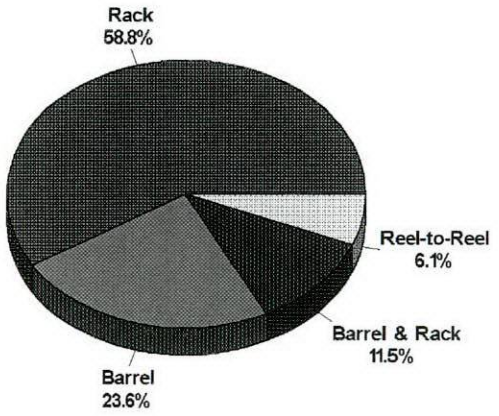


Figure 6 Rack Systems Used in Job Shops

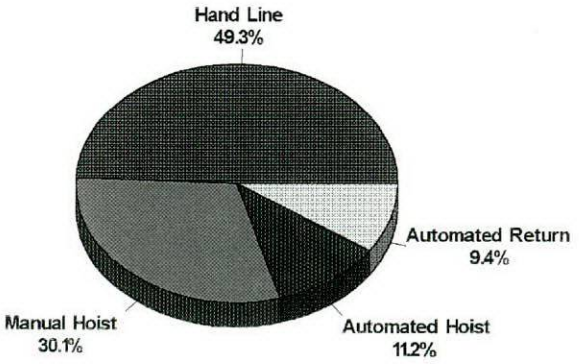


Figure 7 Rack Systems Used in Captive Shops

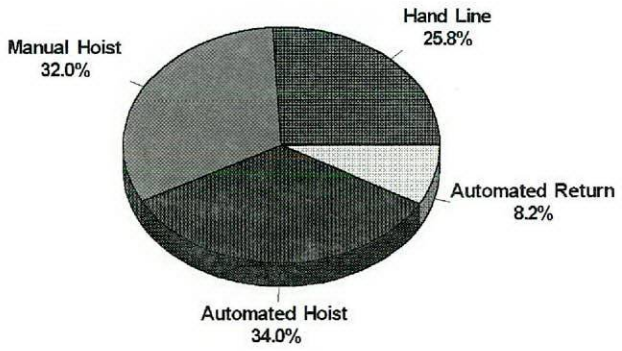
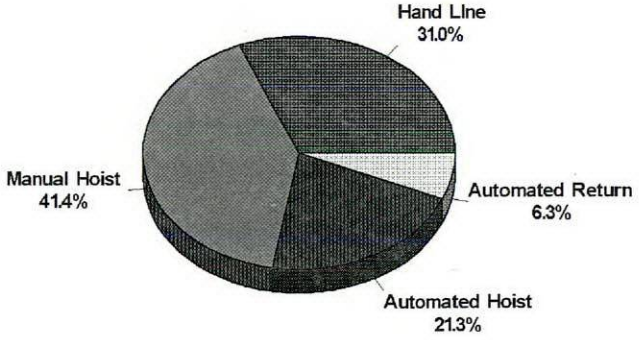
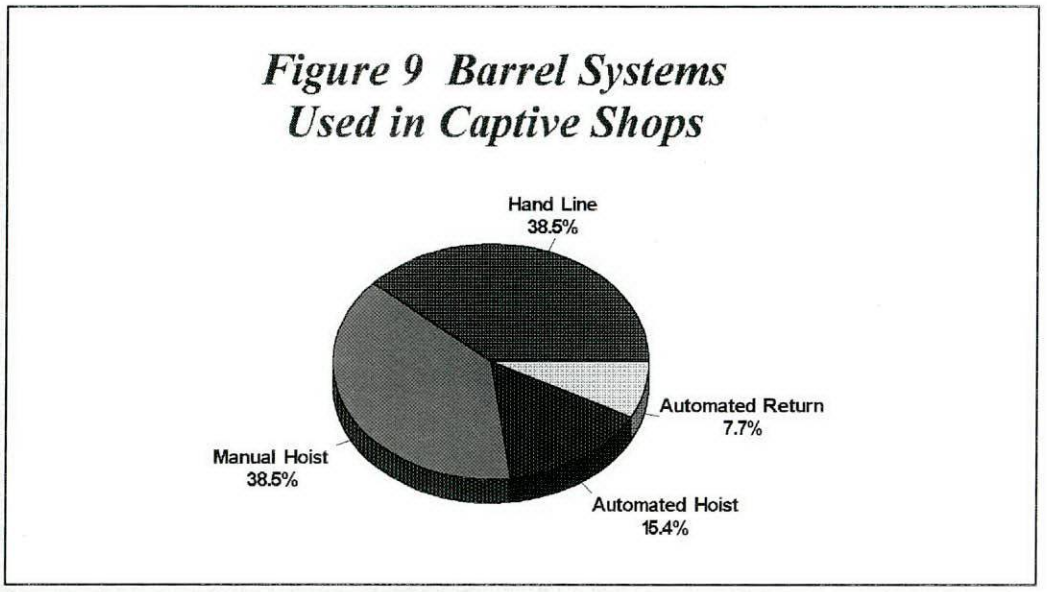


Figure 8 Barrel Systems Used in Job Shops





ECONOMIC OUTLOOK

Sales Volume

The 1997 sales volumes for different size job shops are summarized in Table 20. An increased number of job shops responded in the shop sizes below $2 million in annual revenues (compared to past surveys). This is indicated by the fact that the median sales value was $1.66 million, compared to $1.8 million in the past survey. Also, the average sales per job shop were $3.0 million as compared to $3.6 million for the past survey.

Table 20 Job Shop Sales Volume

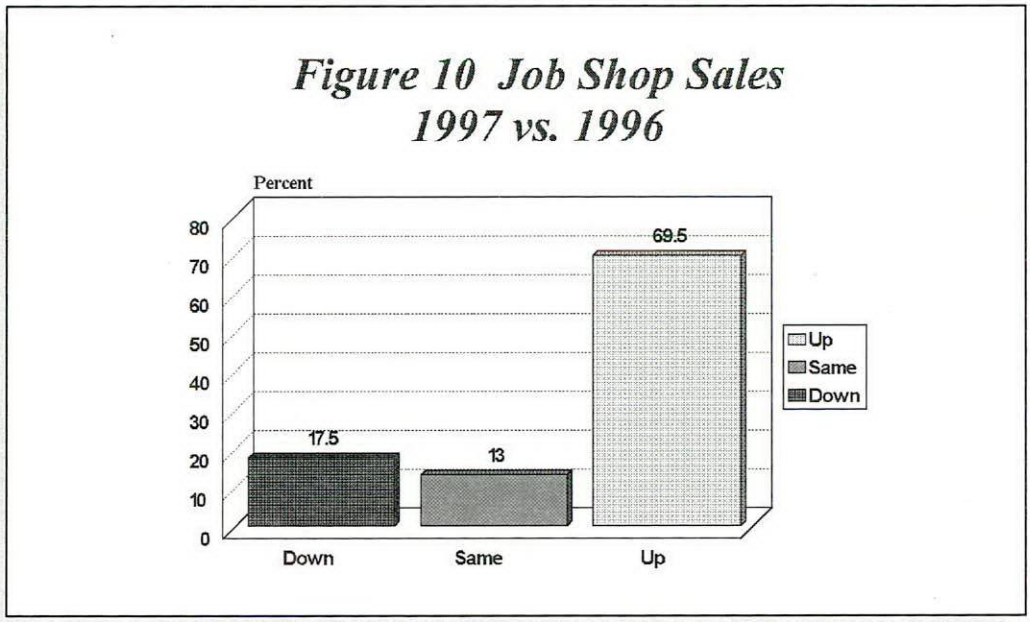
$ Millions	1996	1997
<0.25	22.3%	8.7%
0.25-0.5	*	11.0%
0.5-1	9.7%	15.6%
1-2	19.4%	22.1%
2-3	16.0%	13.3%
3-5	9.7%	12.9%
5-7	6.3%	5.3%
7-10	4.6%	5.3%
10-15	#	3.4%
15-20	#	1.2%
>20	12.0%	1.2%

* Combined above # Combined below

The average sales revenue for job shops from the past surveys has ranged from $2.5 to $3.6 million with revenue per employee ranging from $75,000 to $89,000. The current job shop data indicate an average of $75,000 in sales revenue per employee.

Business Trends

A comparison of the 1997 job shop sales revenue with 1996 is shown in Figure 10. Nearly 70% of all finishers report an increase in year-to-year sales. Less than 20% of job shops reported year-to-year revenue decreases. This indicates that 1997 was a better year than 1996 for job shops.



The distribution of job shops reporting increases is shown in Figure 11. Slightly more than 40% of job shops experiencing sales increases reported them to be 10% or more, also an improvement over 1996. A relatively even distribution of finishers reporting decreases is displayed in Figure 12.

Figure 11 Distribution of Job Shop Sales Increases for 1997 vs. 1996

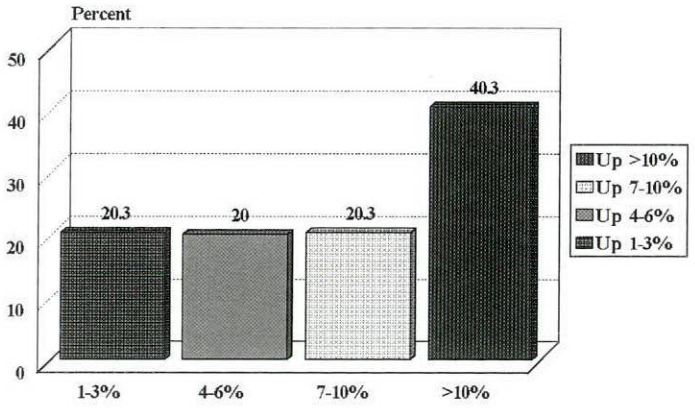
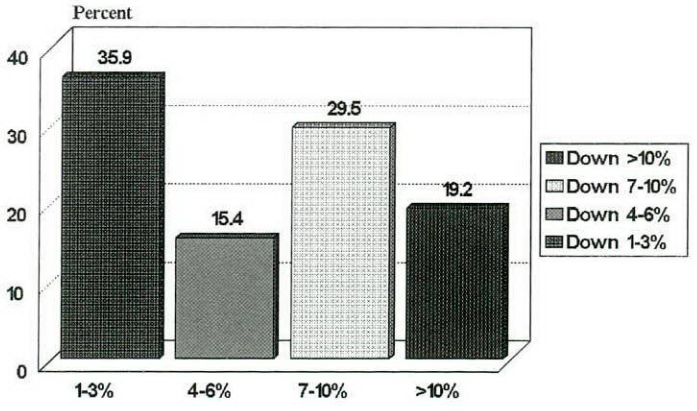


Figure 12 Distribution of Job Shop Sales Decreases for 1997 vs. 1996



Business Forecasts

Nearly 80% of the job shops forecast an increase in business for 1998 as shown in Figure 13. They are even more optimistic for the long term (5 years) with over 90% expecting increases. Only 5% of finishers expect a decrease for 1998. The balance forecast no change. The distribution of the near term and long term sales forecasts are shown in Figures 14 and 15. Over 40% of job shops expect long term sales increases to exceed 10% annually.

Figure 13 Job Shop Sales Outlook

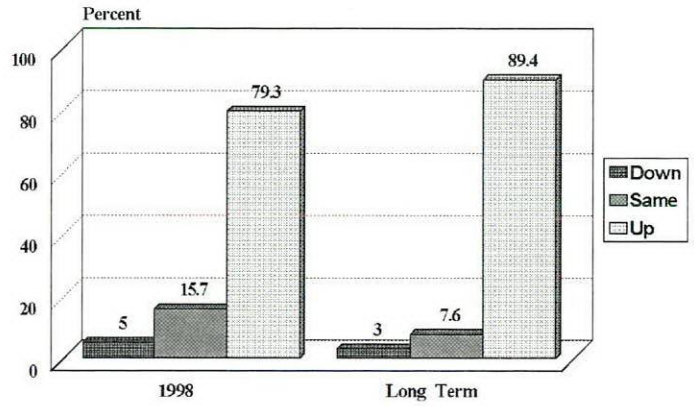


Figure 14 Distribution of Projected Sales Increases for 1998

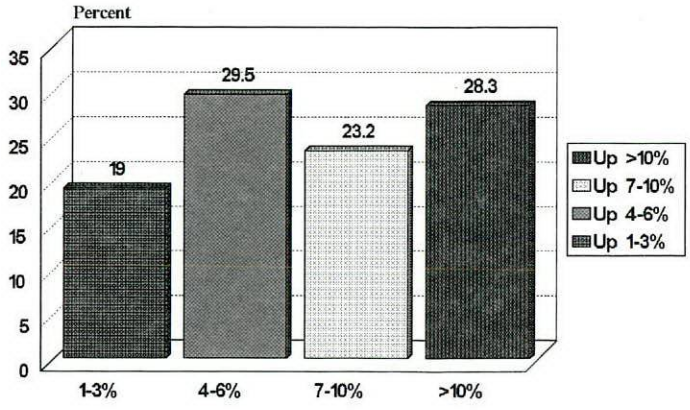


Figure 16 compares the current sales forecast with the past surveys and illustrates a continued strong optimism for business growth in the U.S. metal finishing industry.

Figure 15 Distribution of Projected Long Term Sales Increases

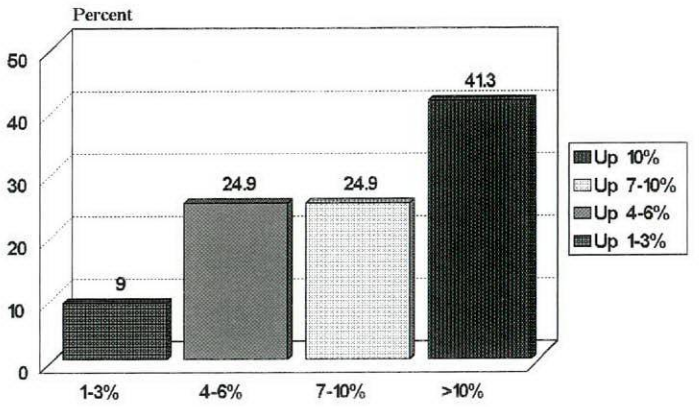
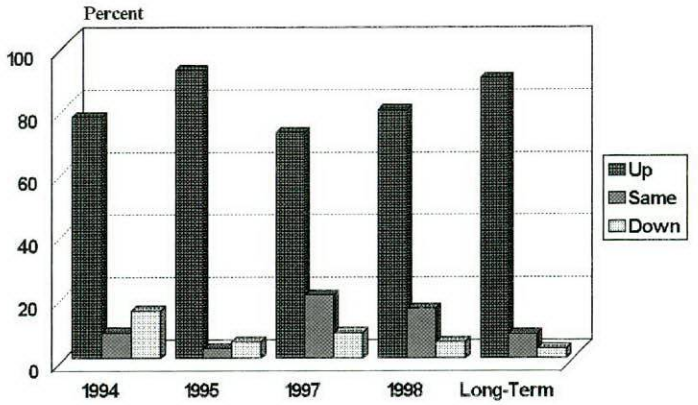


Figure 16 Comparison of Sales Forecasts with Earlier Surveys



JOB SHOP EXPENDITURES

In this section, general operating and capital expenditures are reported for job shop finishers.

Capital

Capital expenditures in 1997 and 1998 (estimated) are summarized in Table 21. Similar to last year, more than two-thirds of all finishing facilities spend less than $100,000 annually for capital equipment. The median expenditure was $43,500 with an average of $120,800.

Table 21 Capital Expenditures for Job Shops

$1,000s	1997	1998 Plans
<10	18.6%	21.1%
10-24.9	19.0%	18.3%
25-49.9	16.8%	16.7%
50-99.9	18.6%	16.1%
100-249.9	16.8%	17.4%
250-499.9	5.9%	5.0%
500-1,000	1.8%	3.4%
>1,000	2.5%	2.0%

Basis: 441 and 442 responses

Payroll

Table 22 summarizes the payroll expense distribution in job shops as a percentage of sales revenue and compares them to the previous survey. The median percentage of sales revenue for payroll was 27%, lower than the 34% reported in the last survey. Earlier surveys (1994, 1995) reported median labor costs for job shops in the 28 to 32% range. The average percentage in this survey was 28%.

Table 23 compares job shop payroll as a percentage of annual revenue for three different total annual sales categories of jobs shops: small (< $1 million), medium ($1-3 million), and large (>$3 million).

Table 22 Job Shop Payroll Costs

% of Sales	1996	1997
<15	13.8%	6.0%
15-19.9	*	13.7%
20-24.9	14.4%	17.8%
25-29.9	20.1%	18.9%
30-34.9	26.4%	18.0%
35-40	11.0%	15.3%
>40	14.3%	10.4%

*Included above; basis: 366 responses in 1997

Table 23 Job Shop Payroll vs. Sales Volume

Payroll % of Sales	<$1 Million	$1-3 Million	>$3 Million
<15	9.2%	2.4%	3.8%
15-19.9	15.1%	11.2%	16.0%
20-24.9	16.0%	20.0%	15.1%
25-29.9	18.5%	17.6%	22.6%
30-34.9	14.3%	19.2%	19.8%
35-40	15.1%	16.8%	16.0%
>40	11.8%	12.8%	6.6%

Selling and Administrative

Table 24 summarizes the selling and administrative (SG&A) expense distribution as a percentage of sales revenue. The average percentage for SG&A in 1997 was approximately 11%. This overhead expense has not been covered in past surveys.

Table 24 Job Shop Selling and Administrative Expenses

% of Sales	1997
<10	44.0%
10-14.9	31.8%
15-19.9	13.3%
20-24.9	4.1%
25-30	4.1%
>30	2.7%

Basis: 368 responses

Materials

Material costs as a percentage of sales revenue are reported in Table 25. In past surveys, SFMRB has suspected that the amount of precious metals involved in an operation may have skewed the value of this expense. Thus, this time both overall and precious metal material costs were surveyed. The average spending on materials, excluding precious metals, was 13.1%. Spending for precious metals was 3.9%. This average includes all shops including those who do not use precious metals. The cost was 7.9% for shops who use precious metals. The data is consistent with past surveys where total material costs were reported in the 14 to 19% range.

Table 25 Cost of Materials for Job Shops

% of Sales	Excluding Precious Metals	Precious Metals Only*
<5	7.5%	57.0%
5-9.9	30.6%	17.5%
10-14.9	27.2%	11.5%
15-19.9	18.5%	6.5%
20-25	11.6%	3.0%
>25	4.6%	4.5%

*Based on 166 respondents (45.4%) who use precious metals

Table 26 compares job shop material costs as a percentage of annual revenue for three different total annual sales categories of jobs shops: small (< $1 million), medium ($1-3 million), and large (>$3 million).

Table 26 Job Shop Material Costs vs. Sales Volume

Material % of Sales	<$1 Million	$1-3 Million	>$3 Million
<5	13.1%	7.7%	1.8%
5-9.9	36.9%	30.0%	24.3%
10-14.9	21.3%	33.1%	27.0%
15-19.9	18.0%	16.2%	22.5%
20-24.9	6.6%	10.8%	18.0%
25-30	2.5%	1.5%	3.6%
>30	1.6%	0.8%	2.7%

Basis: 363 responses

Buildings

Table 27 summarizes the building expense (rent/mortgage) distribution in shops as a percentage of sales revenue. The average percentage for rent and/or mortgage by job shops was 4%. This expense was not covered in past surveys.

Table 27 Building Costs (Rent/Mortgage) for Job Shops

% of Sales	1997
<2	33.4%
2-3.9	24.4%
4-5.9	19.9%
6-7.9	9.3%
8-10	8.2%
>10	4.8%

Basis: 356 responses

Maintenance

Maintenance costs as a percentage of sales revenue are summarized in Table 28. The average value was 4.2% compared to an estimate of 4 to 5% for all finishers in the last survey.

Table 28 Job Shop Maintenance Costs

% of Sales	1997
<2	16.2%
2-3.9	34.9%
4-5.9	31.6%
6-7.9	8.6%
8-10	7.3%
>10	1.4%

Basis: 370 responses

Utilities

The costs of utility services as a percentage of sales revenue are reported in Table 29 and are compared to the last survey. The average is 6.2% compared to 6% in the last survey.

Table 29 Job Shop Utility Costs

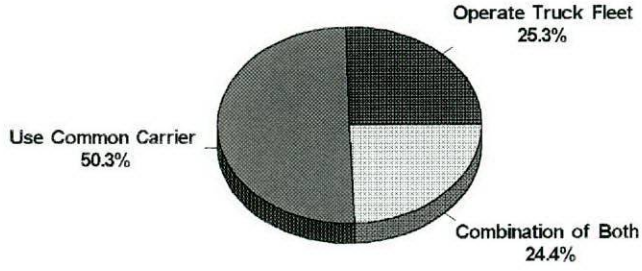
% of Sales	1996	1997
<3	17.0%	11.8%
3-4.9	22.0%	25.0%
5-6.9	26.7%	28.5%
7-9.9	23.3%	21.0%
10-12	5.8%	9.4%
>12	5.2%	4.3%

Basis: 377 responses in 1997

Shipping

Figure 17 shows that approximately half of the job shops ship by common carrier, a quarter by their own fleet, and the rest by a combination of both. A comparison of the cost to job shops to ship their product by either their own fleet or by a combination of fleet and common carrier is made in Table 30. The average cost of a fleet only operation was 2.6 % of revenue with 1.8% of revenue for those using a combination of fleet and common carrier.

Figure 17 Job Shop Shipping Practices



Basis: 324 responses

Table 30 Job Shop Shipping Costs

% of Sales	Fleet Operator	Combination
<1	18.3%	33.3%
1-1.9	23.9%	31.7%
2-2.9	18.3%	16.7%
3-3.9	14.1%	11.7%
4-5	14.1%	1.4%
>5	11.3%	5.0%

Basis: 71 and 60 responses

The prior survey indicated an average cost of 1.7% of sales revenue for freight.

Other

Table 31 displays the job shop costs for health care, workmen's compensation, other insurance, and training versus % of annual sales revenue. The averages were:

Health care 2.6%
Workman's comp. 2.1%
Other insurance 1.9%
Training 1.0%

These values were not reported in past surveys.

Table 31 Other Job Shop Costs

% of Sales	Health Care	Workmen's Comp.	Other Insurance	Training
<1	13.9%	16.9%	25.6%	62.8%
1-1.9	23.1%	39.9%	39.7%	25.3%
2-2.9	25.8%	22.2%	15.4%	8.8%
3-3.9	19.7%	10.5%	8.0%	1.9%
4-5	10.6%	7.2%	6.3%	1.1%
>5	6.9%	3.3%	5.0%	0.0%

Basis: 360 to 363 responses

Average Job Shop

The average values for all the above expenses are combined in Table 32. They total 85.0% for the average job shop with annual sales just under $3,000,000. The balance of 15.0% would represent gross profit before taxes, interest, and depreciation. Table 33 gives average expenses for small, medium, and large shops, with average annual sales volumes of $490,000, $1,880,000, and $7,200,000 respectively.

Large shops tend to spend more for materials, while small shops have a proportionately higher outlay for buildings, insurance, and utilities.

Table 32 Average Job Shop Operating Costs

Expenditure	% of Sales
Payroll	28.0%
General/Administrative	11.4%
Materials	13.1%
Precious Metals	3.9%
Utilities	6.3%
Environmental Materials	3.3%
OSHA	1.1%
Maintenance	4.2%
Buildings	4.0%
Health Care	2.6%
Workmen's Comp.	2.1%
Other Insurance	1.9%
Training	1.0%
Shipping	2.1%
Total	**85.0%**

Average Sales: $2,990,000

Table 33 Average Operating Costs for Small, Medium, and Large Job Shops (% of Sales)

Expenditure	<$1 Million	$1-3 Million	>$3 Million
Payroll	27.3%	29.0%	27.7%
General/Admin.	10.5%	11.8%	12.1%
Materials	11.6%	12.5%	15.2%
Precious Metals	3.5%	3.7%	4.7%
Utilities	6.6%	6.1%	6.1%
Environmental Matl's	2.9%	3.2%	3.8%
OSHA	0.9%	1.1%	1.3%
Maintenance	3.8%	4.3%	4.6%
Buildings	5.0%	3.5%	3.5%
Health Care	2.4%	2.7%	2.8%
Workmen's Comp.	2.3%	2.2%	1.9%
Other Insurance	2.3%	1.8%	1.8%
Training	0.9%	1.0%	1.2%
Shipping	2.0%	2.1%	2.4%
Total	**81.6%**	**84.6%**	**88.5%**

Average Sales: $490,000; $1,880,000; and $7,200,000 respectively

JOB SHOP COMPLIANCE COSTS

In the following sections, data on personnel and the costs (operating and capital) related to job shop compliance with regulations are summarized.

Capital

Total annual capital costs for job shops for regulatory compliance in 1997 and 1998 (estimated) are shown in Table 34. Nearly 50% of shops report annual regulatory related capital spending below $10,000 as compared to 40% last year. The 1997 average is $30,300 as compared to an average of $40,000 for all finishers from the previous survey.

Table 34 Capital Expenses for Job Shop Regulatory Compliance

$1,000s	1997	1998 Plans
<5	27.9%	29.8%
5-9.9	19.7%	21.2%
10-29.9	24.3%	24.1%
30-49.9	12.9%	9.2%
50-99.9	9.8%	10.9%
100-200	2.7%	3.4%
>200	2.7%	1.4%

Basis: 441 and 439 responses

Employees and Their Costs

The numbers of job shop regulatory compliance related employees in each company sales revenue category are shown in Table 35 compared to the last survey. The average number is 2.5 employees compared to 2.8 in the past survey. This means that 6.2% of an average job shop's employees are regulatory-related employees. This percentage is based on the above 2.5 regulatory employees divided by the total average of 40 employees per job shop, calculated earlier in this report from Table 5.

Table 35 Employees Engaged in Compliance-Related Activities

Number	1996	1997
0-1	29.8%	42.4%
2-3	49.5%	38.8%
4-6	14.0%	13.9%
7-10	3.7%	3.1%
>10	3.0%	1.8%

The cost of these regulatory related employees is shown in Table 36 versus sales revenue. The average job shop cost is 2.1% of annual revenue. This means that an average job shop expends 7.5% of its total payroll cost on regulatory-related employees. (This average was calculated by dividing the above 2.1% by the average job shop payroll expenditure reported earlier in this report from Table 22.) Regulatory-related employees appear to cost, on the average, 20% more than average employees, which is logical as these employees require special training and must have additional qualifications.

Table 36 Cost of Environmental Personnel for Job Shops

% of Sales	1997
<1	32.6%
1-1.9	29.8%
2-2.9	18.5%
3-3.9	7.2%
4-4.9	4.7%
5-6.9	4.4%
7-10	1.6%
>10	1.1%

Basis: 362 responses

Environmental Materials and Services

Annual job shop environmental materials and service costs are shown as a function of sales revenue in Table 37 and are compared with the last survey (then called waste treatment and disposal). The average job shop cost was 3.3% compared to 2.8% in the last survey, an 18% cost increase. This may reflect the more encompassing scope of the title used.

Table 38 compares job shop environmental material and services costs as a percentage of annual revenue for three different total annual sales categories of jobs shops: small (<$1 million), medium ($1-3 million), and large (>$3 million).

Table 37 Cost of Environmental Materials and Services

% of Sales	1996	1997
<1	19.8%	13.2%
1-1.9	18.7%	21.2%
2-2.9	19.7%	22.3%
3-3.9	14.0%	13.7%
4-4.9	14.5%	8.5%
5-6.9	*	11.3%
7-10	*	7.1%
>10	13.3%	2.7%

*Included below; basis: 364 job shop responses

Table 38 Job Shop Environmental Material Costs

Material % of Sales	<$1 Million	$1-3 Million	>$3 Million
<1	20.7%	12.3%	6.6%
1-1.9	26.4%	22.1%	14.9%
2-2.9	18.2%	23.0%	25.6%
3-3.9	9.9%	15.6%	15.7%
4-4.9	8.3%	10.7%	6.6%
5-6.9	5.8%	7.4%	20.6%
7-10	7.4%	5.7%	8.2%
>10	3.3%	3.3%	1.6%

OSHA/Safety & Health

Annual OSHA/safety and health costs as a percentage of sales revenue are shown in Table 39 for job shops and are compared to the last survey. The average for job shops was 1.1% as compared to 1.65% reported for all finishers in the last survey.

Table 39 OSHA/Safety and Health Costs for Job Shops

% of Sales	1996	1997
<1	40.1%	58.0%
1-1.9	33.1%	30.2%
2-2.9	12.8%	8.0%
3-3.9	7.0%	2.7%
4-5	4.0%	0.6%
>5	3.0%	0.6%

Basis: 364 responses in 1997

Summary

The compliance operating costs for an average job shop can be determined by adding the average costs from Tables 36, 37, and 39. The result can be seen in Table 40. Thus the average annual cost of compliance amounts to 6.5% of sales or $194,000 for the average shop with a sales volume just under $3,000,000.

Table 40 Compliance Operating Costs for an Average Job Shop

Item	% of Sales
Environmental Payroll	2.1%
Materials & Services	3.3%
OSHA Safety & Health	1.1%
Total	**6.5%**

ASSOCIATION MEMBERSHIP

Associations Involved

Table 41 shows the distribution of association membership by all survey responses. More than half are members of AESF and slightly less than half are members of NAMF, which is indicative of the fact that 88% of all responses came from job shops.

Table 41 Association Memberships of Respondents to Survey #1

Organization	Number
AESF	57.1%
NAMF	45.8%
ASTM	11.0%
SME	10.8%
SAE	9.0%
ASM	8.8%
AAC	2.0%
IPC	1.6%
ASQ	1.2%
IHAA	1.0%

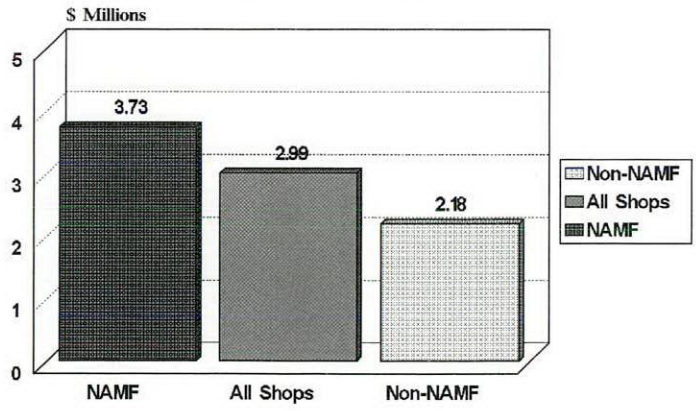
NAMF Member Comparison

SFMRB conducted an analysis of the annual sales levels of all responses relative to their membership in NAMF. The comparison of NAMF vs non-NAMF members is shown in Table 42 and Figure 18, where it is indicated that NAMF membership generally involves the larger job shops, with average sales of $3.73 million. The average sales of non-NAMF members is $2.18 million. It is obvious that smaller shops are not as likely to be members of NAMF.

Table 42 Comparison of Sales Volume of NAMF and Non-NAMF Shops

$ Millions	All Shops	NAMF Shops	Non-NAMF Shops
<0.25	8.7%	2.6%	15.4%
0.25-0.5	11.0%	5.7%	16.8%
0.5-1	15.6%	11.0%	20.7%
1-2	22.1%	25.1%	18.8%
2-3	13.3%	14.5%	12.0%
3-5	12.9%	18.1%	7.2%
5-7	5.3%	7.0%	3.4%
7-10	5.3%	8.8%	1.4%
10-15	3.4%	4.8%	1.9%
15-20	1.1%	1.8%	0.5%
>20	1.1%	0.4%	1.9%

Figure 18 Average Job Shop Sales Volume



All job shop average expenses are compared with NAMF and non-NAMF members · average expenses in Table 43. NAMF shops have a slightly higher payroll, SG&A, environmental material, maintenance, and shipping costs and lower materials, utilities, building, insurance, and capital costs.

Table 43 Average Job Shop Operating Costs (% of Sales Volume)

Expenditure	All Shops	NAMF Shops	Non-NAMF
Payroll	28.0%	28.5%	27.5%
General/Admin.	11.4%	12.4%	10.3%
Materials	13.1%	12.9%	13.3%
Precious Metals	3.9%	3.7%	4.3%
Utilities	6.3%	6.1%	6.4%
Environmental Mat'l's	3.3%	3.6%	2.9%
OSHA	1.1%	1.1%	1.1%
Maintenance	4.2%	4.4%	4.0%
Buildings	4.0%	3.5%	4.5%
Health Care	2.6%	2.7%	2.5%
Workmen's Comp.	2.1%	2.1%	2.1%
Other Insurance	1.9%	1.8%	2.1%
Training	1.0%	1.0%	1.0%
Shipping	2.1%	2.2%	1.8%
Total	**85.0%**	**86.0%**	**81.7%**

Captive and job shop membership in AESF and NAMF is compared in Figures 19 and 20. It shows that 70% of job shops are members of one association or the other (or both) while less than 43% of captive shops are members.

Figure 19 Job Shop AESF/NAMF Membership

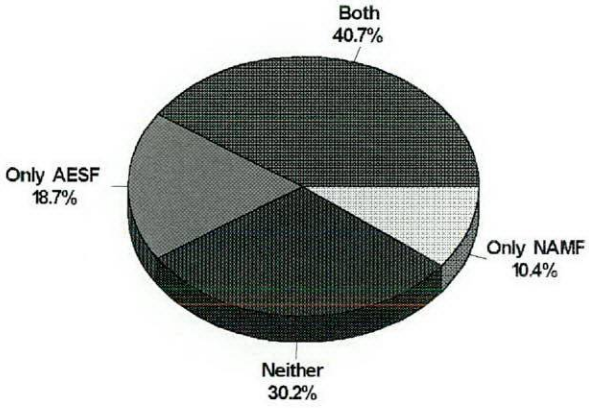
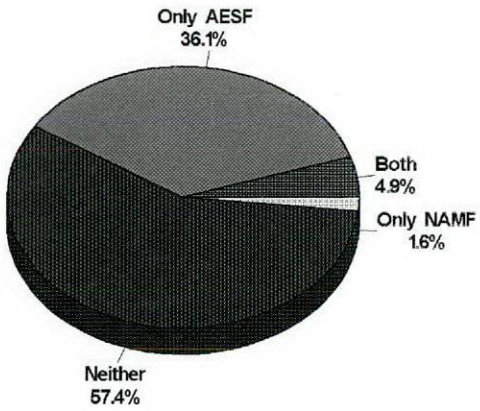


Figure 20 Captive Shop AESF/NAMF Membership



COMPUTER USAGE

Survey #2 was mailed to 2,000 captive and job shops engaged in metal finishing operations (8429 on list). Questions were posed related to computer applications, Internet utilization, and frequency of use of finishing industry web sites. The data from 385 usable responses are reported in this section. Computer and internet usage has become an integral and important part of today's metal finishing businesses.

Applications

Table 44 summarizes basic uses of computers in finishing shops. Of the 217 job shop responses, 198 (91.2%) indicate they make use of computers in the workplace. Also, of the 189 captive responses, 187 (98.9%) use workplace computers. Over 70% of job and captive shops have internet access and CD-ROM readers. Table 45 summarizes the various business functions presently performed by finish ers' computers. All finishers make extensive use of computers for accounting, order entry, and job quoting; however, captive shops make broader use of computers for scheduling/production, quality assurance, and training.

Table 44 Computer Usage in Finishing

	Job Shops	Captive Shops
Use Computers	91.2%	98.9%
Have Internet Access	70.3%	76.9%
Have CD-ROM	72.0%	72.2%

Table 45 Computer Applications Used by Metal Finishers

Task	Job Shops	Captive Shops
Accounting/ Billing	98.0%	90.4%
Order Entry	75.5%	88.2%
Job Quoting	63.6%	71.1%
Scheduling/ Production	56.6%	94.1%
Regulatory Compliance	37.4%	47.6%
Quality Assurance	55.1%	74.3%
Training	24.2%	51.9%
Hoist Control	17.2%	21.9%
Rectifier Control	12.6%	19.2%
Temperature Control	18.7%	35.8%

Internet

There were 202 responses from job shops, and 142 (70.3%) have internet access. Also, of the 195 responding captive shops, 150 (76.9%) have internet access. The internet applications used by finishers is summarized in Table 46. The dominant uses are for E-mail and requests for product information. The frequency of internet/on-line use is summarized in Table 47. There is no particular usage trend other than nearly 80% indicate usage of at least several times per week.

Table 46 Internet Applications Used by Finishers

Tasks	Job Shops	Captive Shops
E-mail	83.8%	82.0%
Chat Lines	7.7%	4.7%
Databases	33.8%	42.0%
Browsing	50.7%	38.7%
Product Information	71.1%	78.7%
Purchase Products	20.4%	23.3%

Basis: 142 job shops (70.3%) and 150 captive shops (76.9%) have Internet access

Table 47 Frequency of On-Line Usage by Finishers

Frequency	Job Shops	Captive Shops
Several per Day	30.9%	22.7%
Once per Day	21.6%	26.7%
Several per Week	28.8%	28.0%
Once per Week	7.2%	6.0%
Less than Once/Week	11.5%	16.7%

Basis: 139 job shop and 150 captive shop responses

Metal Finishing Web Sites

The use of the various metal finishing industry web sites by job shop and captive shop operators is summarized in Table 48. Apparently, job shop web site usage and awareness is much more prevalent than for captive shops. Captive shops may be less focused on metal finishing and more interested in general production/manufacturing issues.

Table 48 Most Popular Finishing Web Sites

Site	Job Shops	Captive Shops
aesf.org	30.3%	14.0%
finishing.com	34.5%	14.7%
metal-finishing.com	41.5%	13.3%
mfsa.org	4.2%	2.7%
namf.org	24.6%	2.7%
nmfrc.org	15.5%	4.0%
pfonline.com	3.5%	1.3%

Basis: 142 finishers with Internet access

QUALITY CONTROL

Survey #2 also posed questions related to present quality control practices used by finishers. Quality control practices vary considerably, depending on the markets and applications served.

Quality Control Practices

Over 400 responses were received from finishers relating to their quality control practices, these are summarized in Table 49. Quality control practices for job and captive finishing shops are similar with the captive shop usage slightly higher in the majority of cases.

Table 49 Quality Control Practices Used by Finishers

	Job Shops	Captive Shops
QC/QA Manual	84.2%	88.3%
Procedure for Rejects	86.6%	95.4%
Incoming Inspection	77.3%	84.7%
MIL STD 105 Sampling	43.5%	55.0%
In-Process Audits	81.9%	87.0%
Solution Analysis	93.2%	89.7%
SPC/SQC	55.5%	68.1%
Regular Calibration	93.9%	90.3%

Record-Keeping Practices

Table 50 indicates the status of record keeping regarding solution analysis while Table 51 summarizes the practices of job and captive shops regarding the retention of solution maintenance logs. The programs for both groups are similar, with more than 85% of the records retained for at least a year.

Table 50 Record Retention for Solution Analysis

	Job Shops	Captive Shops
Not Retained	5.3%	12.8%
<1 year	3.4%	4.3%
1 year	22.7%	28.9%
3 years	33.8%	30.5%
>3 years	34.8%	23.5%

Table 51 Retention of Solution Maintenance Logs

	Job Shops	Captive Shops
Not Retained	9.0%	15.8%
<1 year	3.5%	3.4%
1 year	26.0%	33.9%
3 years	26.5%	26.0%
>3 years	35.0%	20.9%

Use of Statistical Control

Statistical control (SQC/SPC) usage by both job and captive shops is summarized in Table 52. Measurements of thickness, pH, temperature, and solution concentration are the most widely used by both groups. Part dimension control is more important for captive shops than for job shops.

Table 52 SPC/SQC Applications in Finishing Shops

	Job Shops	Captive Shops
Process Time	31.6%	20.8%
Ampere Hours	20.0%	10.0%
Current Density	14.5%	11.5%
Concentrations	52.1%	37.7%
pH	61.5%	40.8%
Temperature	54.7%	41.5%
Thickness	75.2%	62.3%
Corrosion Tests	14.5%	20.8%
Part Dimensions	19.7%	45.4%
Color Matching	7.7%	7.7%
Waste Monitoring	27.3%	26.9%

Quality Control Levels

The present and planned quality certification levels of captive and job shops are summarized in Tables 53 and 54. ISO 9000 is the most popular program with nearly 50% of captive shops presently certified. The next most popular program is QS 9000. The other programs listed are indicated to have a very low interest level by all metal finishers. Table 55 summarizes the military quality control system levels presently held by metal finishers with MIL I 45208 the most frequently held by job shops and MIL Q 9858 the most frequent among captive shops.

Table 53 Quality Levels Held or Anticipated by Job Shops

	Certified/ Registered	Applied for	Plan to Apply
QS 9000	1.8%	6.0%	14.7%
AS 9000	<1%	<1%	2.8%
ISO 9000	9.6%	6.0%	23.4%
ISO 14000	<1%	<1%	8.7%
NADCAP	1.8%	<1%	1.8%

Table 54 Quality Levels Held or Anticipated by Captive Shops

	Certified/ Registered	Applied for	Plan to Apply
QS 9000	12.8%	4.6%	2.6%
AS 9000	<1%	<1%	17.9%
ISO 9000	48.7%	6.1%	8.2%
ISO 14000	<1%	2.1%	6.7%
NADCAP	<1%	<1%	<1%

Table 55 Military Quality Control System Levels Held by Finishers

	Job Shops	Captive Shops
MIL Q-9858	13.8%	14.9%
MIL I-45208	22.5%	8.7%
MIL STD 120	6.0%	7.7%
MIL STD 45662	13.8%	6.7%

BATH LIFE EXTENSION

Survey #2 made inquiries into the practices metal finishers use to extend the life and/or improve the performance of processing solutions. Details were obtained on solutions used for cleaning/surface preparation, plating, anodizing, and conversion coating. The data from both captive and job shop responses are summarized in this section.

Cleaning/Surface Preparation

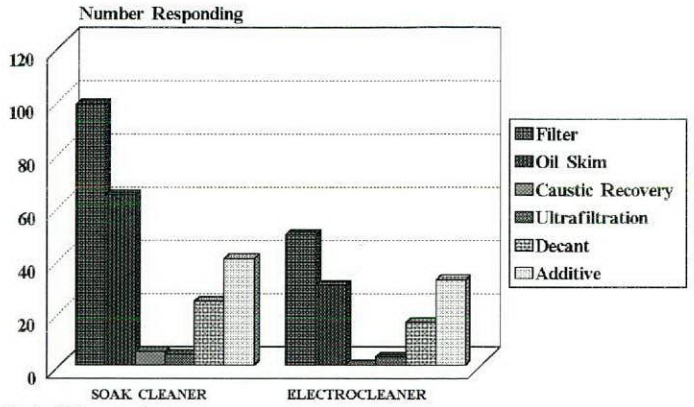
The most popular techniques for cleaning/surface preparation bath life extension from 320 responses are summarized in Table 56. The cost effectiveness of each technique is also reported. Filtration is the most common technique used, by nearly three quarters of the responders, and this method is also perceived as the most cost effective of the various options. The average cost effectiveness for all the techniques used is just over 80%. Decanting, as might be expected, is the least cost effective.

Table 56 Processes for Extending the Life of Cleaning and Surface Preparation Baths

Process	In Use	Cost Effective
Filtration	72.8%	86.3%
Chemical Additives	54.4%	76.4%
Oil Removal	45.6%	84.2%
Decanting	21.9%	68.6%
Acid Retardation	14.1%	80.0%
Ultrafiltration	11.9%	73.7%
Caustic Regeneration	9.1%	79.3%
Overall		**80.5%**

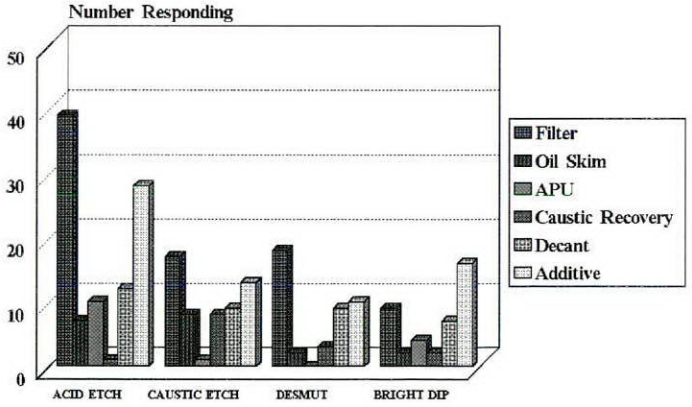
The various methods used for extending the life of specific cleaning/pretreatment solutions are summarized in Figures 21, 22, 23, and 24. Filtration and oil skimming are the dominant techniques for soak cleaners followed by the use of chemical additives and decanting as illustrated in Figure 21. The same techniques are used for electrocleaners but here the use of filtration is not as dominant although it is still the most popular. Figure 22 indicates the techniques used with bright dips and etchants with acid dips shown in Figure 23. Filtration and chemical additives are the dominant techniques for acid dips and etchants with additives most popular in bright dips. Favored methods for use with stannate and zincate immersion treatments for plating on aluminum are shown in Figure 24. Once again filtration and chemical additives are favored.

Figure 21 Methods for Extending the Life of Cleaning Solutions

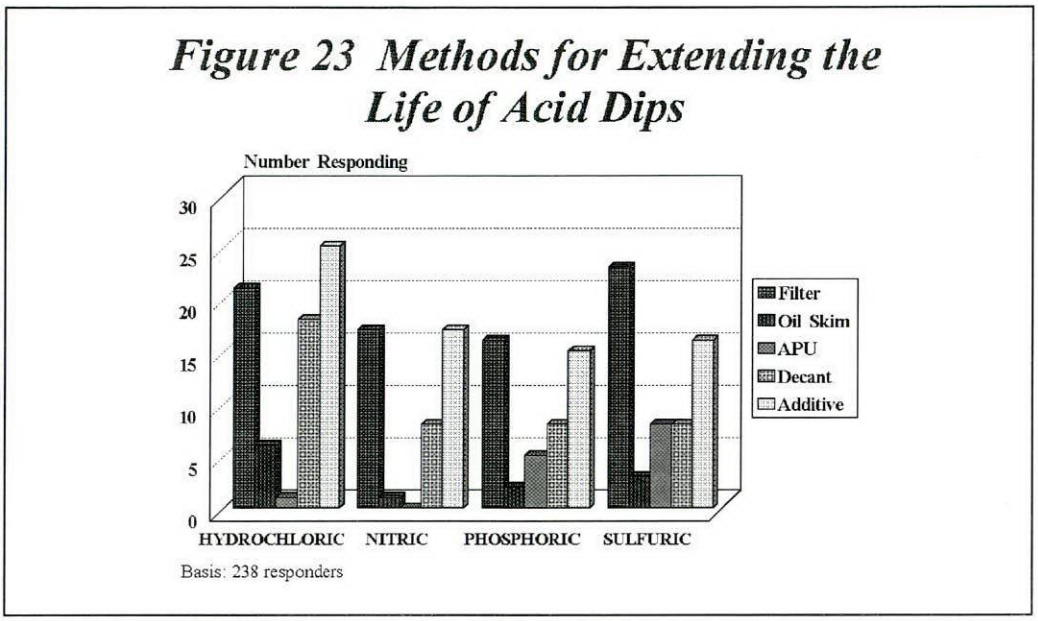


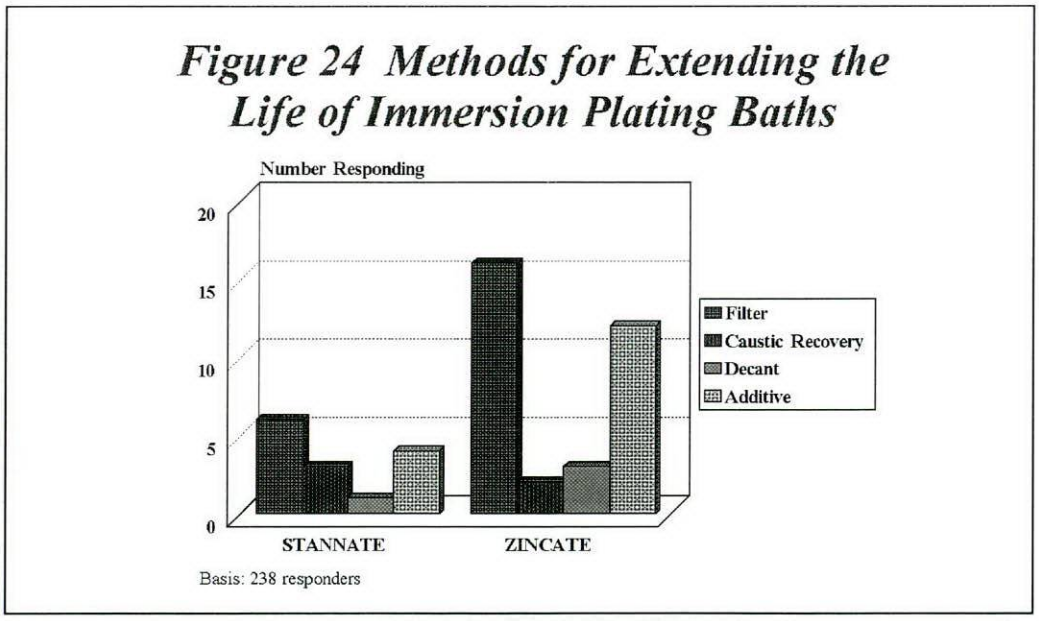
Basis: 238 responders

Figure 22 Methods for Extending the Life of Bright Dips and Etchants



Basis: 238 responders





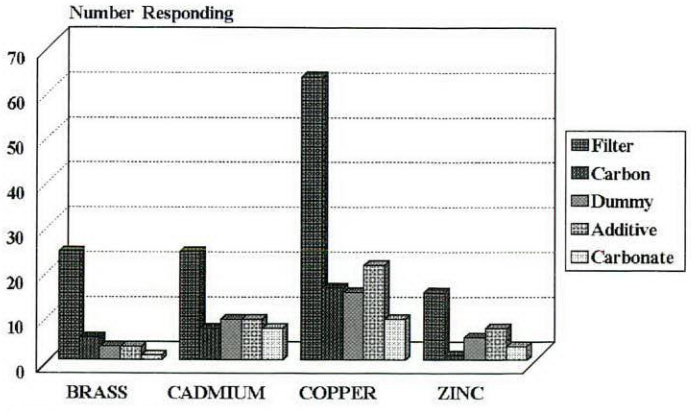
Plating

The techniques used and their cost effectiveness for extending the life and/or performance of plating baths, as obtained from 273 responses, is summarized in Table 57. Filtration is the most common technique used and is also the most cost effective. The average cost effectiveness of all the techniques used to extend plating bath life is nearly 85%. The frequency of use of the most popular techniques for each of the common plating baths is summarized in Figures 25 through 30. Filtration is the overall dominant technique for all plating baths. See, for example, Figure 25, which reports usage for brass, cadmium, copper, and zinc cyanide; Figure 26, which reports acid copper, tin, and zinc baths; Figure 27, which reports alkaline tin, alkaline zinc, and tin-lead; and Figure 28, which reports gold and silver.

Table 57 Methods for Extending the Life of Plating Baths

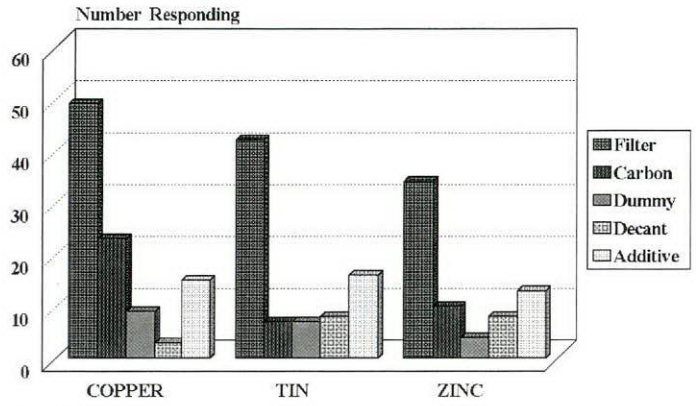
Process	In Use	Cost Effective
Filtration	89.4%	88.9%
Chemical Additives	53.5%	79.5%
Carbon Treatment	52.7%	88.2%
Dummying	46.2%	83.3%
Decanting	18.7%	70.6%
Carbonate Removal	16.5%	84.4%
Overall		**84.5%**

Figure 25 Methods for Extending Cyanide Plating Bath Life



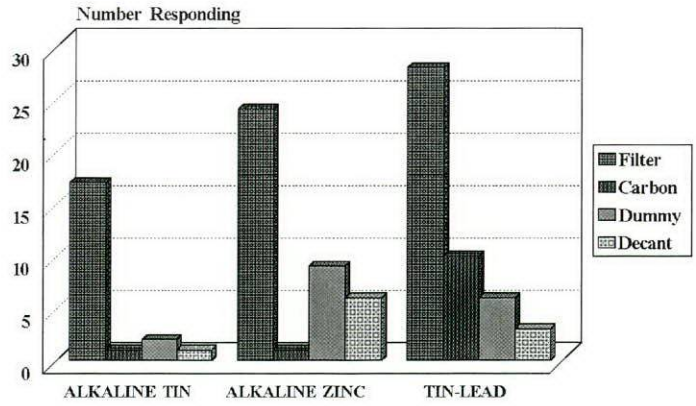
Basis: 242 responders

Figure 26 Methods for Extending Acid Plating Bath Life

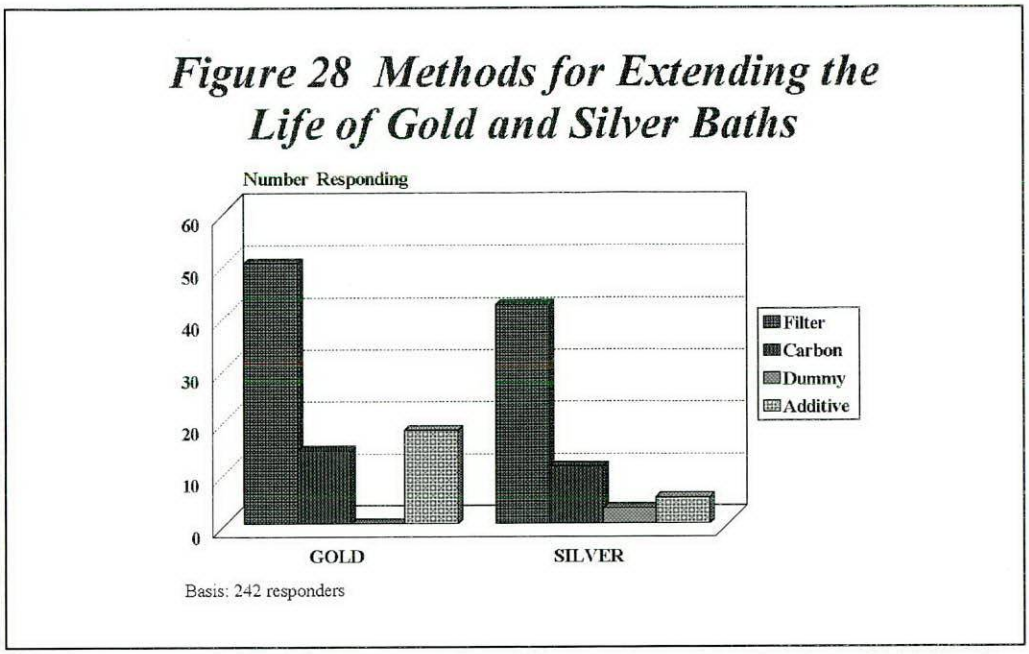


Basis: 242 responders

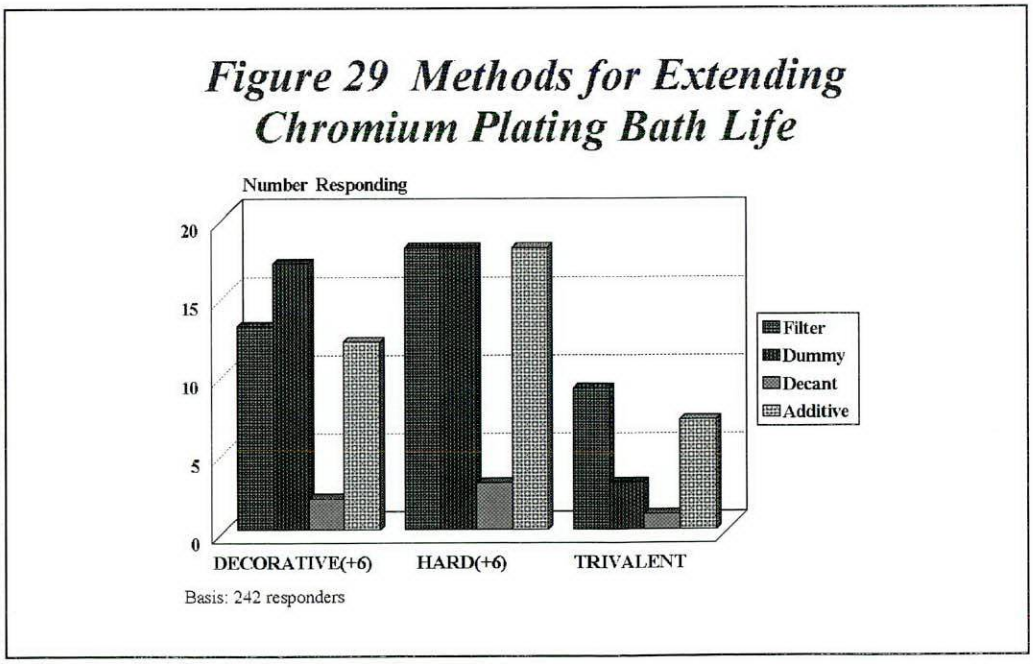
Figure 27 Methods for Extending the Life of Other Plating Baths

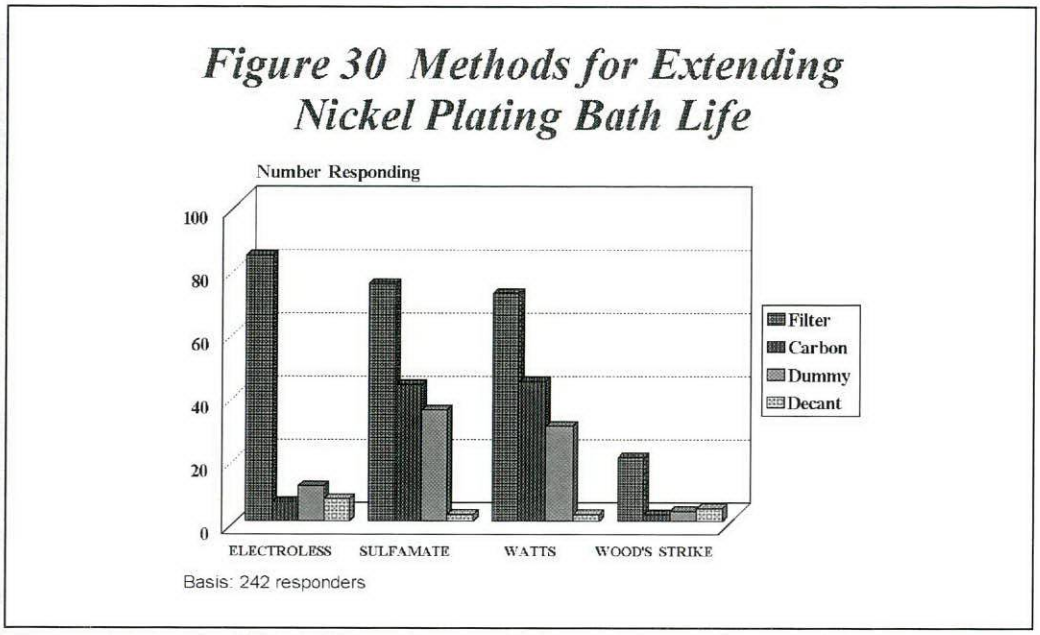


Basis: 242 responders



The picture is more complicated for chromium plating solutions as shown in Figure 29. Filtration is one of a trio of techniques used in conjunction with hexavalent chromium solutions along with dummying and chemical additives. Trivalent chromium plating baths combine filters and additives. Techniques used for nickel plating baths are given in Figure 30. Filtration is again dominant with carbon treatment and electrolytic dummying frequently used for sulfamate and Watts electrolytes.





Anodizing/Conversion Coating

The responses from 106 metal finishers regarding their anodizing/conversion coating bath life extension practices are summarized in Table 58, which shows that filtration is the most popular with decanting/desludging and chemical additives also key techniques. An average cost effectiveness of more than 87% is indicated. All anodizing baths except phosphoric acid use all three as shown in Figure 31. These three techniques are also used for anodizing dye baths and seals, listed in Figure 32, along with chromate and phosphate conversion coatings. Acid purification units can be added to these three techniques for treatment of phosphating baths.

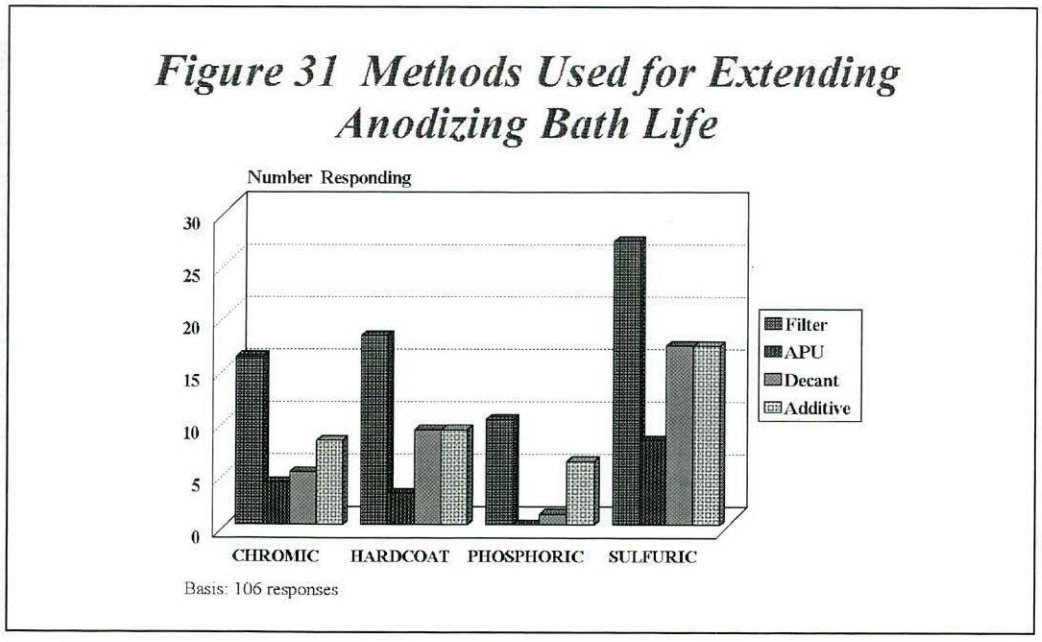
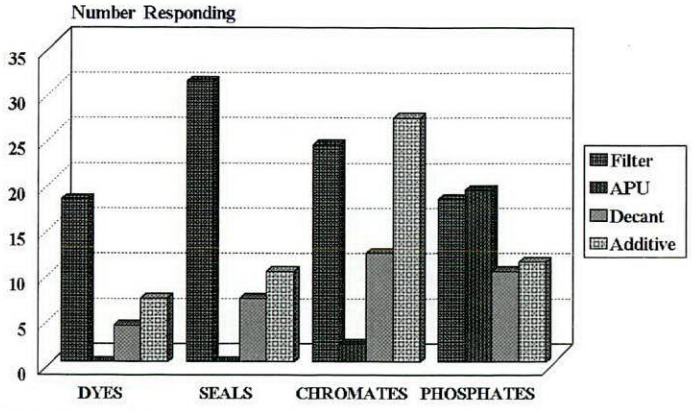


Table 58 Methods for Extending the Life of Anodizing and Conversion Coating Baths

Process	In Use	Cost Effective
Filtration	70.9%	92.2%
Chemical Additives	52.5%	83.6%
Decant/ Desludge	37.0%	87.2%
Acid Purification	14.2%	83.3%
Overall		**87.7%**

Figure 32 Methods for Extending the Life of Other Baths



Basis: 106 responders

CUSTOMIZED STUDIES

The data that support all the information included in this report are stored in several Excel spreadsheets. For a modest fee, the SFMRB will analyze situations specific to your own business and prepare a customized report. Special reports can be generated in several ways to customize the information for individual requirements. For example, much of the data reported could be incorporated for one geographical region, such as New England. Several examples of the types of analyses that could be performed are shown in the following tables.

Table 59 compares the sales volumes of all job shops with those who perform nickel/chromium or zinc plating. Zinc plating shops appear to be generally larger than the average.

Table 59 Sales Volume of Zinc and Nickel-Chromium Job Shops

$ Millions	All Shops	Ni-Cr Shops	Zn Shops
<0.25	8.7%	10.8%	2.3%
0.25-0.5	11.0%	5.8%	6.9%
0.5-1	15.6%	14.2%	14.5%
1-2	22.1%	21.7%	23.1%
2-3	13.3%	10.8%	16.8%
3-5	9.2%	10.8%	17.3%
5-7	5.3%	5.8%	7.5%
7-10	5.3%	9.2%	5.8%
10-15	3.4%	7.5%	5.2%
15-20	1.1%	1.7%	0.6%
>20	1.1%	1.7%	0%

Table 60 is a comparison of the utility costs of all job shops by region. Shop costs for specific types of processes (e.g., hard chromium plating) or for a combination of specific processes and geographic areas could also be prepared as customized reports.

Table 61 is a comparison of job shop sales volume versus several market segments. A wide range of combinations is possible. Consult with SFMRB through the sponsoring organizations for details.

Table 60 Utility Costs by Region for Job Shops

% of Sales	New England	Mid Atlantic	East Central	West Central	West
<3	20.0%	6.8%	9.6%	7.8%	10.0%
4-4.9	27.5%	15.9%	16.4%	28.1%	28.8%
5-6.9	20.0%	36.4%	32.9%	37.5%	26.3%
7-9.9	22.5%	22.7%	24.7%	15.6%	23.8%
10-12	7.5%	9.1%	11.0%	9.4%	5%
>12	2.5%	9.1%	5.5%	1.6%	6.3%

Table 61 Job Shop Sales Volume by Market Segment

$ Millions	All Shops	Computers/ Electronics	Fasteners
<0.25	8.7%	5.5%	6.1%
0.25-0.5	11.0%	9.5%	10.2%
0.5-1	15.6%	13.6%	12.2%
1-2	22.1%	19.5%	24.5%
2-3	13.3%	13.6%	17.3%
3-5	12.9%	12.3%	14.3%
5-7	5.3%	6.8%	8.2%
7-10	5.3%	6.4%	3.1%
10-15	3.4%	5.0%	4.1%
15-20	1.2%	4.1%	0%
>20	1.2%	3.6%	0%

The SFMRB can also provide, at a more substantial fee, a diskette(s) containing the database to enable you to complete your own customized analyses.

CHALLENGES FACING METAL FINISHERS

The final response on the Fall 1997 survey was unlike the others. It was the only one requiring a statement rather than simply filling in a blank or checking off one of a multiple choice series of possibilities. The question posed was as follows: "What do you see as the greatest challenge to your metal finishing operations in the next 5 years?"

Table 62 summarizes the challenges listed in 364 of the 511 questionnaires, i.e., 71.2% supplied an answer. The overwhelming and most frequent response was environmental compliance, mentioned by 67.2% of those responding. The second most frequent response was finding qualified labor (20.1%).

Note that the totals in Table 62 add up to more than 100% since many respondents listed more than one challenge. Some of the typical remarks are quoted below.

Table 62 Challenges Facing Finishers

Challenge	Response
Environmental Compliance	67.6%
Finding Qualified Labor	20.1%
Increased Costs	9.1%
Domestic Competition	8.2%
Foreign Competition	7.1%
Increasing Sales	6.6%
OSHA/Health & Safety Compliance	5.5%
Quality Improvement	5.5%
Customer Service Issues	3.3%
Technical Issues	3.0%
Automation/Equipment Upgrade	3.0%
Loss of Manufacturing	2.7%
Others	3.8%

Basis: 364 responses (some gave more than one)

Environmental Compliance

"Thrashing through government regulations (local, state, federal, etc.) to determine what is or is not applicable to our facility. The intent and spirit of regulation is appropriate and needed; however, the complexity and shear volume of regulations presents major hurdles for those attempting to comply and may be actually causing more harm than good."

"Staying one step ahead of the proliferation of regulations to make a profit."

"Record keeping and regulatory requirements."

"Coping with constantly changing, increasing, and overlapping regulations, many of which are so detailed and voluminous as to be essentially meaningless and beyond practical application for a small company."

"Unrealistically low limits for the materials introduced into the sanitary district. There are instances where the limits are lower than the impurities that come into our facility from city water. A bit perverse."

"...keeping up with and understanding regulations. Its difficult for a small shop to find out what they should and shouldn't do."

"Silly regulations that treat zinc as hazardous waste."

"Increasingly stringent wastewater regulations."

"...staying within ever tightening hazardous waste regulations."

"Meeting environmental regulations, especially air emissions."

"Government regulations beyond the ability of finishing class personnel to understand."

"Over-regulation by OSHA and EPA."

"Site clean-up demands and the costs associated with it."

"I believe the city of ... would prefer not to have this type of industry in its city limits. We have been inspected by every department ...in the past year."

"EPA's failure to enforce ... standards has placed a heavy burden on those of us who came into early compliance."

Finding Qualified Labor

"We feel the greatest challenge ... is obtaining qualified platers."

"Securing quality operators to support expansion."

"Getting and keeping good personnel."

"Hiring and training new people."

"Retaining high quality employees while keeping payroll in line."

"Finding trainable employees who speak English and understand basic math."

"Finding responsible and knowledgeable people that are willing to work in the metal finishing industry."

Increased Costs

"Prices on gas, electric, phone, etc."

"Controlling energy cost."

"Reducing costs — electric, gas, water, hospitalization, insurance, and payroll."

"Health care costs."

Domestic Competition

"Noncompliance shops with lower prices."

"Increase in processes to replace metal(s)."

"Competition from powder coaters."

"Replacement of metals with man-made materials."

"Job shops not knowing what their services are worth — low balling."

Foreign Competition

"Retaining business versus Mexico."

"Remaining competitive on large, long-term contracts in world market."

"Local jewelry manufacturers · ability to compete with foreign markets."

"...how do we compete in the low-profit, high-overhead U.S. against third world countries that have low overhead?"

"Overseas competition from the Pacific Rim and Mexico."

"Cheap foreign imports — they have few OSHA/EPA problems."

"Movement to Mexico due to NAFTA."

"Amount of work that will stay domestic instead of going offshore."

Others

"Getting more work into the shop."

"Productivity increase to meet mandated price reductions."

"Replacements for out-of-favor finishes."

"Market plan to differentiate firm."

"ISO 9000 compliance."

"Whether manufacturing base will hold its own or decrease in California."

"Meeting automotive standards."

"Public and media chemical hysteria and ignorance."

"Maintaining quality and service."

"Decline of New England as a manufacturing (base)."

"QS 9000."

"Keeping manufacturers in the Northeast so we can have customers."

"Expansion of facility."

"Remaining competitive through new technologies and processes."

"NADCAP's increased stranglehold with its unfettered opportunity for imposing financial burden. (See also ISO 9000.)"

"Diversify industry we're able to serve."

"Need to automate."

"...to accommodate increased customer expectations."

SFMRB MEMBERSHIP

Sylvia Baxley	Plating and Surface Finishing
Richard W. Fleet	Light Metals Coloring
Dennis Foster	Delta Faucet
Herbert N. Gerhardt, Jr.	General Super Plating Co.
Curtis Goad	Goad Co.
Beverly Graves	Products Finishing
Robert T. Groom	Reilly Plating Co.
Jeffrey Higdon	Victoria Plating Co.
Kenneth Lemke	Canadian Finishing Systems Ltd.
David K. Lucas (Consultant)	D.K. Lucas and Associates
David Marsh	Marsh Plating Corp.
Michael Murphy (Chairman)	Metal Finishing
Steve Schaefer	LeaRonal Inc.
Robert R. Sizelove	Canning Gumm
Howard M. Smith	Atotech USA Inc.
Milton F. Stevenson, Sr.	Anoplate Corp.

MOVING FORWARD TOGETHER

SFMRB

Surface Finishing Market Research Board

SFIC

Surface Finishing
Industry Council

AESF

American Electroplaters
and Surface Finishers
Society, Inc.

mfsa

Metal Finishing
Suppliers' Association

NAMF

National Association of
Metal Finishers

AESF

American Electroplaters and Surface Finishers Society, Inc.

MOVING FORWARD TOGETHER

SFMRB

Surface Finishing Market Research Board

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Metal Finishing Suppliers' Association

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National Association of Metal Finishers

METAL FINISHING INDUSTRY MARKET SURVEY

1996-1997

MOVING FORWARD TOGETHER

SFMRB

Surface Finishing Market Research Board

SFMRB METAL FINISHING INDUSTRY MARKET SURVEY

1996-1997

This report is published by the American Electroplaters and Surface Finishers Society (AESF), the Metal Finishing Suppliers' Association (MFSA), and the National Association of Metal Finishers (NAMF) as a service to the metal finishing industry and contains information based on input from companies in the industry. The information published in this report was developed from actual historical information, and does not include any quantitative projected information.

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Surface Finishing Market Research Board

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EXECUTIVE SUMMARY

In recognition of the need for statistical information on the metal finishing industry, the American Electroplaters and Surface Finishers Society (AESF), the Metal Finishing Suppliers' Association (MFSA), and the National Association of Metal Finishers (NAMF) have joined together to support the Surface Finishing Market Research Board (SFMRB). The Board is composed of representatives of the sponsoring organizations, who meet to discuss methods to gather the data of interest, implement these methods, and then compile and report the results.

This report is the third in the SFMRB series of reports. The initial report was completed in March 1994 and the second report in June 1995. These earlier reports provided estimates of the total size, employment, and contribution to the economy of the metal finishing industry as well as providing an economic outlook and details on market segments, processes, and equipment. This report confirms and updates some of the previous data.

Procedures for the current report differed somewhat from the earlier studies. In the Spring of 1996 a preference survey was conducted to determine specific areas of interest to members of the three sponsoring organizations. The results of this preference survey indicated strong interest in four areas: approaches to zero discharge, the economic outlook for finishers, the cost of compliance with environmental and safety regulations, and substitutes for hazardous materials. These topics were the core of the items covered in this report. Additional areas of high interest that were addressed included cleaning and pretreatment practices, finishing processes in use, and industries served by finishers.

Some of the key findings, which are further detailed in the text of the report, were as follows:

- The majority of finishers reported increases in sales volume for 1996 over 1995.
- A strong majority of finishers forecast an increase in sales volume for 1997.
- The metal finishing industry involves about 10,000 companies with 500,000 employees generating $48 billion in revenue and contributing about $40 billion to the gross domestic product of the U.S.
- The outlook of job shop anodizers is brighter than that for general metal finishing.
- An average captive or job shop plating facility requires 3 to 4 employees to handle compliance-related activities.
- Over 40% of captive shops are not aware of the value of the intercompany services they provide to their corporations.
- One-third of the captive shops don't know the cost of their operations and many who report costs appear to underestimate overhead and waste treatment expenses.
- Over 50% of metal finishers practice some form of resource recovery as an integral part of their production process with over 80% reporting that these techniques are cost effective.
- Nearly 50% of finishers have replaced or eliminated some hexavalent chromium containing processes, and nearly 60% have replaced or eliminated some cyanide containing processes from their plants.
- Nearly 75% of plating and anodizing shops have replaced chlorinated solvents in their plants with two-thirds of these opting for aqueous cleaning processes as the substitute.

PURPOSE OF SFMRB

The metal finishing industry in North America has been faced with dramatic economic, technical, and regulatory challenges in recent decades. An industry under diverse pressures needs basic statistical information to know where it stands and to guide its future course. The Surface Finishing Market Research Board (SFMRB) was created in 1991 to meet this need.

SFMRB is jointly funded and supported by the American Electroplaters and Surface Finishers Society (AESF), the Metal Finishing Suppliers' Association (MFSA), and the National Association of Metal Finishers (NAMF). The first two SFMRB reports, completed in 1994 and 1995, focused mainly on the status of the electroplating portion of the metal finishing industry.

The information has helped both metal finishers and their suppliers to make better decisions regarding areas for business development and has provided the industry with more detailed information regarding employment and commercial activity for use in presentation to governmental and regulatory bodies.

This report was prepared to update the previous studies and to explore some additional areas of interest to the industry.

PREFERENCE SURVEY

In the Spring of 1996 a preference survey was conducted to determine the areas of interest of members of the sponsoring organizations (AESF, MFSA, and NAMF) regarding topics to be investigated by the SFMRB for 1996-1997. This survey was comprised of a simple questionnaire proposing about two dozen possible areas for investigation. It was distributed at the NAMF/MFSA Joint Meeting in Palm Springs in March 1996 and at selected AESF branch and regional meetings. Completed surveys were collected by board members or returned by fax. A total of 370 useful responses was received. The top four areas of interest were as follows:

- Approaches to zero discharge
- Economic outlook for finishers
- Cost of compliance with environmental and safety regulations
- SubstituteÏs for chromium, cadmium, and other hazardous materials.

Other areas of interest to the majority of respondents included:

- Methods for increasing bath life
- Industries served by finishers
- Finishing processes in use and their cost
- Use of quality assurance tools
- Educational needs of finishers
- Cleaning and pretreatment practices.

The SFMRB met in June 1996 during AESF SUR/FIN in Cleveland to set plans for 1996-1997. It was decided to address the top four areas from the preference survey and to include as many of the additional areas as possible.

METHODOLOGY

In earlier SFMRB surveys a merged mailing list was compiled from several of the industry trade publications and associations. The individual lists from each organization were merged into a master list by a bonded mailing house. Questionnaires were then mailed to the bulk of the mailing list and the returns processed through a CPA to ensure confidentiality. Return rates, although acceptable, were low and the process entailed the expense of merging and checking as well as the fees for the CPA. An improved, less costly procedure was desired.

For the current surveys it was decided to utilize mailing lists supplied by a single industry trade publication *(Products Finishing)*, which also offered to handle the mailing, printing, and collection of returns at minimal expense to the SFMRB. The lists were provided without rental charge. A random selection was made from the particular lists of interest for each topic area. The lists consisted of only captive and job shop finishers in the United States who conducted the operations concerned in the survey questions. The merged lists used in past surveys were larger as they also included suppliers, consultants, laboratories, distributors, and other such organizations related to the industry, but who were not metal finishers.

An effort was made to ensure a higher rate of return this year than the past surveys. The questionnaires were designed to be anonymous, brief, and easy to fill out. It was also felt that several shorter questionnaire forms, mailed separately, would result in a better response than one long form. Furthermore, each questionnaire was sent with a strong covering letter and a dollar bill to further encourage participation.

The MFSA Pretreatment Committee prepared a draft survey to cover the area of cleaning and pretreatment practices. It was adopted and used by the SFMRB.

Upon collection the results for the completed questionnaires were compiled by the staff at *Metal Finishing* without charge to the SFMRB.

Mailing Lists/Responses

A total of four separate surveys was conducted.

Survey #1. This was sent in late October 1996 to 1,000 captive and job shops engaged in plating and anodizing operations. It posed questions related to resource recovery and to cleaning and pretreatment practices.

Survey #2. This was sent in late October 1996 to 1,000 captive and custom coaters engaged in pretreatment for painting and powder coating. It posed questions related to cleaning and pretreatment practices.

Survey #3. This was sent in late March 1997 to 1,250 captive and job shops engaged in plating and related finishing operations. It posed questions related to sales, employment, cost of operations, and the economic outlook for 1997.

Survey #4. This was identical to Survey #3 except that it was directed to 250 anodizing shops. It was also sent out in late March 1997.

Table 1 Survey Responses

	Survey #1	Survey #2	Survey #3	Survey #4
List Size	8866	2674	8866	1358
Number Mailed	1000	1000	1250	250
Usable Returns	241	403	406	84
Response Rate	**24.1%**	**40.3%**	**32.5%**	**33.6%**

Surveys #1 and #2 conducted 11/96; #3 and #4 conducted 3/97

Table 2 Comparison of Survey #3 Response to Previous Reports

	1992-1993	1993-1994	1997
Number of Plants	13621	14258	8866
Surveys Mailed	8000	14258	1250
Usable Returns	182	383	406
Response Rate	**2.3%**	**2.7%**	**32.5%**

The response rate for each survey is summarized in Table 1. The rates of response for all of the current surveys were excellent. A comparison of the resulting responses from finishers in Survey #3 with past surveys is shown in Table 2. Considering the quality and quantity of the responses, and the results from previous surveys, SFMRB believes the values currently reported to be plus or minus 5 to 10% of reality. This compares to 10 to 20% in previous surveys.

BASIC INFORMATION

Business Orientation

Figure 1 shows the distribution of responses between captive and job shops. (A captive shop provides metal finishing services within a manufacturing company; a job shop provides finishing services for a fee.) The data are based on responses from 210 captive shops, 189 job shops, and 7 combined captive and job shop operations, which have been treated as captive shops in this report. The percentage breakdown of captive and job shop responses compared with past surveys is shown in Table 3. There was a much greater response rate from captive operations in this survey compared with the past two surveys.

Figure 1 Type of Facility

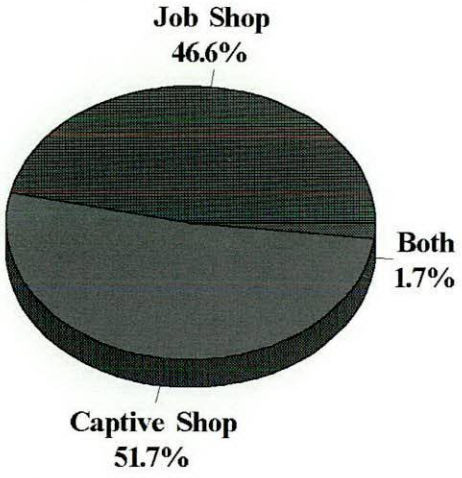


Table 3 Comparison of Facility Types Responding to Surveys

Survey	Captive Shops	Job Shops
1992-1993	32%	68%
1993-1994	22%	78%
1996-1997	53.4%	46.6%

Basis: 406 responses in 1996-1997

Plant Locations

The plant site percentages in eight U.S. geographical regions are shown in the accompanying map (Figure 2) and Table 4. Over 45% of the responding finishers are located in the Midwest. This is consistent with past studies, which are also shown in Table 4.

Table 5 gives the plant locations for job shops. This was compared to another listing of job shops compiled by the staff of *Metal Finishing* from telephone directory yellow pages. The total number of job shops, based on the telephone directories, is 4,291.

From Table 1 the list size for Survey #3 is 8,866. The percentage of job shops, based on the response shown in Figure 1, is 46.6%. This calculates to 4,132 job shops. If you also include the shops that reported combined captive and job shop operations, and may have yellow page listings, the result is 4,282 job shops. This is in excellent agreement with the yellow pages total.

There are, however, a number of anomalies in the breakdown of plant locations reported in Table 5. The New England, Mid-Atlantic, and Northwest regions are in good agreement, but the number of job shops in the Central areas is much lower in the yellow page listings than in the Survey #3 mailing list. A geographical breakdown of the total mailing list indicates that there was a higher than normal response from these regions, perhaps as much as 20%. Also, the numbers for the West and Southwest regions are considerably higher and the Southeast somewhat higher in the yellow pages.

Investigation of the breakdown for individual states showed that there were especially higher numbers of shops in the yellow page listings for California in the West and Texas in the Southwest with Florida contributing the higher numbers for the Southeast.

Figure 2 Geographical Regions for Tables 4 and 5

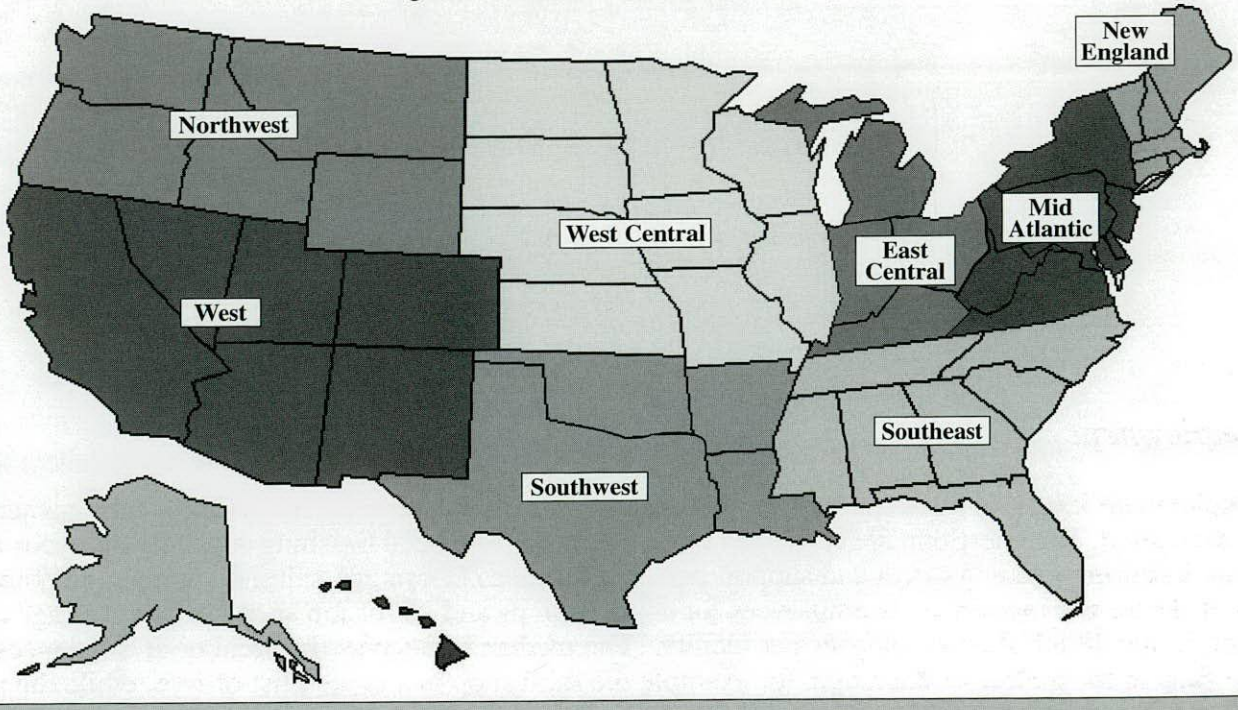


Table 4 Plant Locations of Respondents

Region	1992-1993	1993-1994	1996-1997
New England	8.4%	7.9%	7.6%
Mid-Atlantic	16.6%	12.0%	15.6%
Southeast	5.9%	8.7%	10.1%
East Central	28.0%	19.7%	22.9%
West Central	17.9%	18.9%	23.4%
Southwest	4.2%	8.2%	4.5%
West	19.0%	20.5%	11.8%
Northwest	In West	In West	4.1%

Basis: 397 shop responses for 1996-1997

Table 5 Comparison of Plant Locations for Job Shops

Region	Survey #3	Yellow Pages
New England	8.1%	8.5%
Mid-Atlantic	13.5%	14.2%
Southeast	8.7%	10.1%
East Central	26.0%	14.9%
West Central	21.6%	14.0%
Southwest	1.6%	8.9%
West	15.1%	24.9%
Northwest	5.4%	4.5%

Employment

Employment levels for both captive and job shop operations are summarized in Table 6 by percentage in each level. The questionnaire requested the total number of metal finishing related employees at the plant location including direct and support personnel such as laboratory, sales, shipping, and management. There is a median of 19 employees for captive shops and 28 for job shops and an average of 46 captive and 48 job shop employees per facility. (The median is taken as the number of employees for the shop in the middle of the range, for example the third shop in a ranked list of five; while the average is the sum of all employees for all shops divided by the number of shops.) Also, there is a large

Table 6 Number of Employees Engaged in Metal Finishing

Range	Captive Shops	Job Shops
1-10	33.2%	25.4%
11-20	19.8%	12.7%
21-30	12.0%	16.4%
31-50	9.2%	18.0%
51-75	7.8%	7.4%
76-100	6.0%	6.9%
101-200	6.0%	10.6%
>200	6.0%	2.6%

Basis: 217 captive and 189 job shop responses

Table 7 Finishing Plant Floor Space

1,000 sq. ft.	Captive Shops	Job Shops
<10	40.2%	29.4%
10-20	23.3%	26.7%
20-30	14.0%	11.2%
30-50	10.3%	15.5%
50-100	6.1%	10.7%
>100	6.1%	6.5%

Basis: 214 captive and 187 job shop responses

concentration of metal finishers who have l0 or fewer employees.

In past surveys job shops were indicated to have an average of 32 to 33 employees. The captive shop employment levels were predicted to average 54 in 1992-1993 and 33 in 1993-1994. The results reported in this study are considered to be more indicative of the actual industry situation due to the high response rate.

Facility Size

The distribution in factory sizes is shown in Table 7. The median captive shop operation size is approximately 18,000 sq. ft., whereas the median job shop size is indicated to be about 19,000 sq. ft.. The average size captive shop facility is about 27,000 sq. ft., with the average job shop 33,000 sq. ft.. The average job shop sizes were reported as 25,000 and 35,000 sq. ft. respectively in 1992-1993 and 1993-1994, which is fairly consistent with this report. Captive shop facility sizes were not reported in previous studies. There appears to be a particularly large concentration of small facilities (less than 10,000 sq. ft.) especially among captive shops.

Industries Served

Table 8 lists the industry segments served by both captive and job shops. Respondents were asked to indicate the top three industry segments served. Many captive shops listed only one or two segments.The machinery/industrial equipment segment is the highest for all finishers. Automotive OEM and computer/electronics are next for job shops and defense/government and computer/electronics are next for captive shops. It is not surprising that if the two automotive segments (OEM and aftermarket) were combined they would be the most dominant segment for all finishers. This is consistent with past surveys.

Table 8 Industries Served by Finishers (Frequency of Top Three Selections)

	Captive Shops	Job Shops
Appliances	10.1%	10.8%
Automotive/Truck, OEM	21.2%	37.6%
Automotive/Truck, Aftermarket	16.1%	19.9%
Building/Construction	11.0%	13.4%
Civilian Aircraft/Aerospace	16.6%	11.8%
Computer/Communications/Electronics	23.5%	31.7%
Defense/Military/Government	23.0%	18.3%
Furniture/Fixtures	7.4%	12.9%
Hardware/Tools	12.4%	21.0%
Jewelry/Watches	1.4%	5.9%
Machinery/Industrial	26.7%	38.7%
Medical	5.5%	<1.0%
Sporting Goods/Toys	3.7%	5.4%
Wire Goods/Pipe	6.0%	11.3%

Basis: 217 captive and 186 job shop responses; captive shops tend to report only 1 or 2

Table 9 Electroplating Processes in Use

Process	Captive Shops	Job Shops
Brass	10.1%	14.4%
Bronze	2.9%	5.0%
Cadmium	5.8%	13.3%
Chromium (Decor.)	14.0%	23.8%
Chromium (Hard)	9.7%	17.1%
Copper	25.6%	40.9%
Gold	15.0%	23.3%
Indium	1.0%	<1.0%
Lead	2.9%	1.7%
Nickel	42.0%	54.1%
Nickel Alloys	4.3%	5.5%
Palladium & Alloys	1.4%	5.5%
Platinum	2.4%	1.1%
Rhodium	<1.0%	3.3%
Ruthenium	<1.0%	1.1%
Silver	11.1%	21.5%
Tin	14.5%	22.7%
Tin-Lead	8.2%	9.4%
Tin-Nickel	2.9%	2.8%
Zinc	26.0%	30.9%
Zinc Alloys	3.9%	5.0%

Basis: 207 captive and 181 job shop responses

Table 10 Electroless Plating Processes in Use

Process	Captive Shops	Job Shops
Copper	5.3%	3.3%
Gold	5.0%	2.8%
Nickel	15.5%	26.0%
Palladium	<1.0%	1.7%
Silver	1.9%	1.7%
Tin	3.4%	<1.0%

Basis: 207 captive and 181 job shop responses

Processes Employed

The significant processes employed by both captive and job shops are shown in Tables 9 to 12. The figures do not add up to 100% since almost all the respondents are engaged in several different process operations. Table 9 gives electroplating processes, Table 10 electroless plating processes, and Table 11 lists additional finishing operations. Respondents wrote in additional processes that were not included in the questionnaire. These included painting and powder coating (see Table 12).

Table 11 Other Finishing Processes in Use

Process	Captive Shops	Job Shops
Chromic Acid Anodizing	7.2%	3.9%
Decorative Anodizing	1.9%	6.1%
Hardcoat Anodizing	8.2%	6.1%
Antiquing	7.7%	11.6%
Blackening	17.4%	17.7%
Bright Dipping	19.8%	15.5%
Chromate Conversion Coating	27.0%	32.0%
Nonchromate Conversion Coating	7.7%	6.1%
Electropolishing	11.6%	10.5%
Hot Dipping	3.4%	<1.0%
Immersion Plating	2.4%	10.5%
Phosphating	23.1%	37.0%
Metal Stripping	28.5%	37.0%
Paint Stripping	20.8%	13.8%
Vacuum Coating	6.8%	2.8%

Basis: 207 captive and 181 job shop responses

ECONOMIC OUTLOOK

Sales Volume

The 1996 sales volumes for captive and job shops are summarized in Table 13. The larger response from big job shops (compared to past surveys) is indicated by the fact that the median sales is $1.8 million with an average of $3.6 million per company. The larger number of small captive shop operations is indicated by a median sales level of $680,000 and an average of $3.5 million per company. Captive shops were asked to estimate the value of intercompany services or to check a box if unknown. Of the responding captive shop operations 42% indicated that they were not aware of the value of their intercompany services by checking the box marked unknown.

Table 12 Write-in Mentions of Additional Finishing Processes

	Captive Shops	Job Shops
Blasting	<1.0%	2.2%
Etching	<1.0%	1.7%
Dip Painting	<1.0%	2.2%
Electrocoating	1.9%	3.9%
Mass Finishing	1.4%	<1.0%
Passivation	<1.0%	3.9%
Polishing and Buffing	1.4%	6.6%
Powder Coating	4.8%	3.9%
Spray Painting	8.2%	1.1%

Processes written in by respondents not truly representative of total usage in finishing

Table 13 1996 Finishing Sales Volume

$ Millions	Captive Shops	Job Shops
<0.5	36.6%	21.2%
0.5-1.0	20.3%	9.2%
1.0-2.0	8.1%	18.4%
2.0-3.0	4.9%	15.2%
3.0-5.0	8.9%	9.2%
5.0-7.0	0.8%	6.0%
7.0-10.0	3.3%	11.4%
>10.0	17.1%	4.9%

Basis: 123 captive and 184 job shop responses; 89 captive shops stated unknown

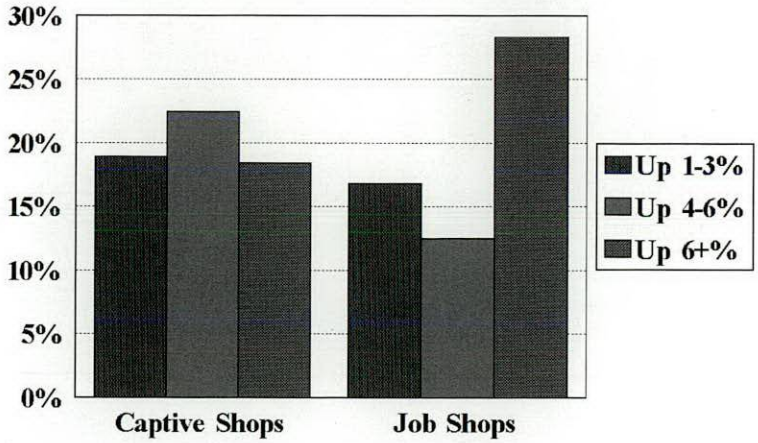
The average sales revenue for job shops from the past two surveys was in the $2.5 to $2.6 million range with revenue per employee at $80,000 to $89,000. The current data indicate a slightly lower average of about $75,000 in sales revenue per employee for all shops.

Figure 3 1996 Sales over 1995



Basis: 201 captive and 184 job shop responses

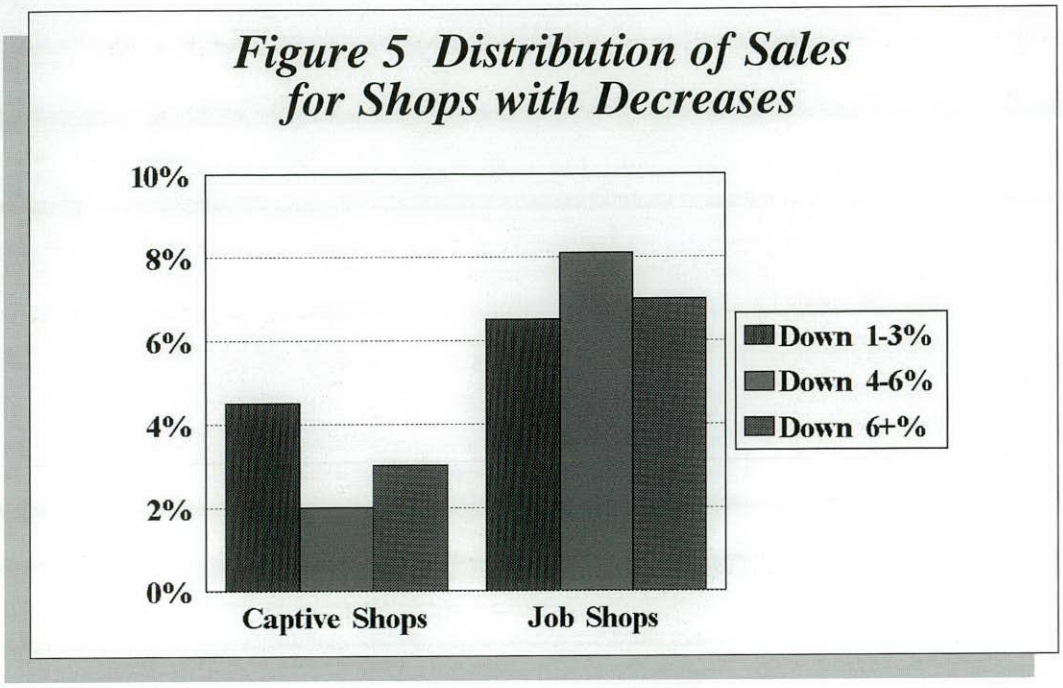
Figure 4 Distribution of Sales for Shops with Increases

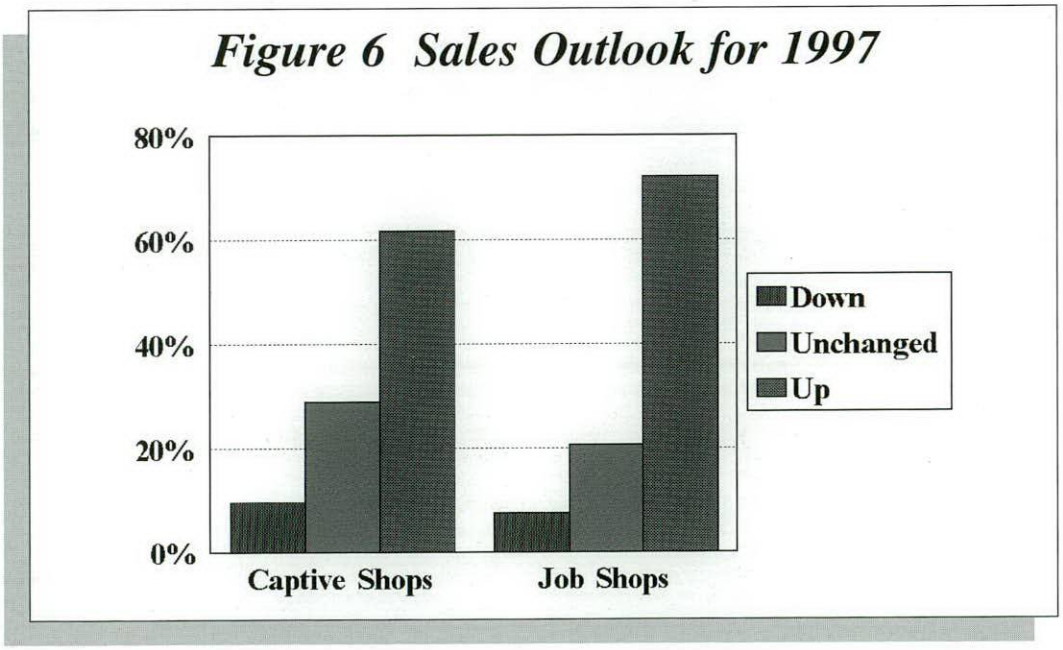


Business Trends

A comparison of 1996 sales revenue with 1995 is shown in Figure 3. Nearly 60% of all finishers report an increase in year-to-year sales. Less than 10% of captive shops and less than 20% of job shops reported year-to-year revenue decreases.

The distribution of finishers reporting increases is shown in Figure 4. Nearly 50% of job shops who experienced increases reported them as 6% or more.



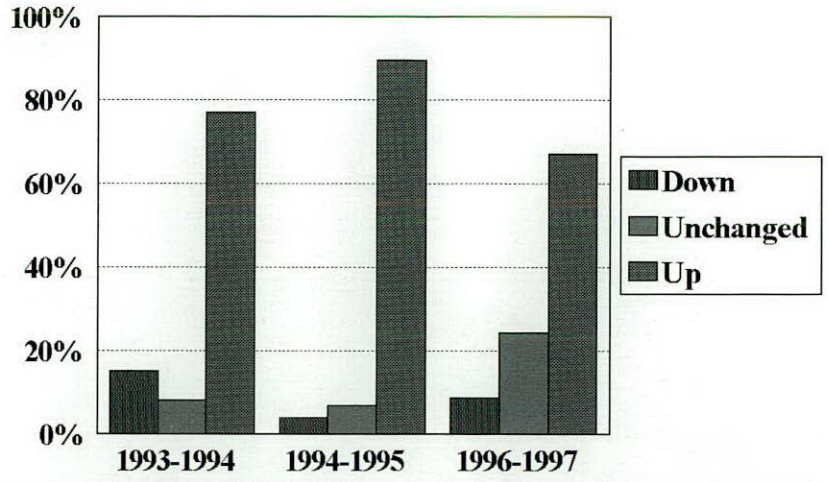


The distribution of finishers reporting decreases is displayed in Figure 5. More job shops reported decreases in sales levels than did captive shops.

Business Forecast

More than half of the captive shops and two-thirds of the job shops forecast an increase in business for 1997 as shown in Figure 6. Less than 10% of finishers expect a decrease for 1997. The balance forecasted no change. This is not as optimistic as previous surveys when 75 to nearly 90% of finishers forecasted increases (see Figure 7).

Figure 7 Comparison of Sales Forecast with Earlier SFMRB Surveys



GENERAL EXPENDITURES FOR FINISHERS

In this section general operating and capital expenditures are reported for finishers.

Capital

Capital expenditures for captive and job shop facilities for 1996 and 1997 (estimate) are summarized in Tables 14 and 15. It indicates that more than half of all finishing facilities spend less than $100,000 annually for capital equipment. SFMRB did not request enough detail in the spending segment below $100,000 to establish an accurate estimate of the average spending by each facility.

Table 14 Capital Expenditures for Captive Shops

$1,000s	1996	1997
<100	57.1%	54.5%
100-250	14.1%	15.8%
250-500	11.8%	12.0%
500-1,000	8.5%	9.6%
>1,000	8.5%	8.1%

Basis: 212 and 209 responses

Table 15 Capital Expenditures for Job Shops

$1,000s	1996	1997
<100	56.1%	57.6%
100-250	24.6%	23.1%
250-500	10.2%	8.3%
500-1,000	4.3%	6.6%
>1,000	4.8%	4.4%

Basis: 187 and 182 responses

Operating - Payroll

Table 16 summarizes the payroll expenses including overhead of captive and job shops as a percentage of sales revenue. Nearly 30% of the captive shops did not respond to this question, possibly indicating a lack of awareness of this information by their management. Furthermore, for nearly half of the captive shops that did respond, their payroll is less than 20% of revenue, likely the result of a high degree of automation and not including corporate overhead salaries. The median for all captive shops is about 21%. The median payroll for job shops was much higher at 34%, likely the result of less automation and their inclusion of all salaries. The past surveys reported labor costs for job shops in the 28 to 32% range.

Table 16 Payroll Costs as a Percentage of Sales Revenue

	Captive Shops	Job Shops
<20%	44.5%	13.8%
20-24%	18.5%	14.4%
25-29%	15.3%	20.1%
30-34%	8.9%	26.4%
35-39%	6.4%	11.0%
>40%	6.4%	14.3%

Basis: 157 captive and 174 job shop responses

Table 17 Other Employee Costs as a Percentage of Sales Revenue

	Captive Shops	Job Shops
<2%	19.0%	13.3%
2-3%	22.4%	21.0%
4-5%	22.4%	28.0%
6-7%	16.3%	15.7%
8-10%	11.7%	11.0%
>10%	8.2%	11.0%

Basis: 147 captive and 172 job shops

Operating—Other Employee Costs

Other employee costs (such as benefits, education, and training) as a percentage of sales revenue are shown in Table 17. The median for all finishers is between 3 and 4% and the average is approximately 5%.

Operating—Materials

Finishing material costs as a percentage of sales revenue are reported in Table 18. The median for all finishers is about 17%. The average material costs are approximately 17.7% for captive shops and 19.3% for job shops. Past surveys reported material costs in the 14.3 to 19% range. The inclusion of precious metal plating shops in determining the average and median material costs may skew these values upward.

Table 18 Cost of Materials as a Percentage of Sales Revenue

	Captive Shops	Job Shops
<15%	41.5%	35.2%
15-20%	23.1%	30.7%
21-25%	12.2%	17.4%
26-30%	10.2%	7.5%
31-35%	7.0%	4.0%
>35%	6.0%	5.2%

Basis: 147 captive and 173 job shops responses

Table 19 Cost of Maintenance as a Percentage of Sales Revenue

	Captive Shops	Job Shops
<3%	26.4%	25.3%
3-4%	23.6%	22.3%
5-6%	25.0%	23.0%
7-10%	12.1%	18.2%
10-12%	9.5%	6.5%
>12%	3.4%	4.7%

Basis: 148 captive and 170 job shop responses

Operating—Maintenance

Maintenance costs (machinery, buildings, equipment) as a percentage of sales revenue are summarized in Table 19. The median value is in the 4 to 5% range for all finishers.

Operating—Utility Services

The costs of utility services (gas, electric, etc.) as a percentage of sales revenue are reported in Table 20. The median is about 3.9% for captive shops and 5.4% for job shops. The comparable averages are approximately 5% and 6% respectively. These higher job shop rates are likely due to the fact that captive shops may not be as aware of all the utility costs allocated to plating.

Table 20 Cost of Utility Services as a Percentage of Sales Revenue

	Captive Shops	Job Shops
<3%	23.2%	17.0%
3-4%	31.7%	22.0%
5-6%	25.3%	26.7%
7-10%	12.7%	23.3%
10-12%	2.1%	5.8%
>12%	5.0%	5.2%

Basis: 142 captive and 172 job shop responses

Table 21 Cost of Trucking as a Percentage of Sales Revenue

	Captive Shops	Job Shops
<1.0%	33.5%	34.3%
1.0-1.9%	25.8%	21.0%
2.0-2.9%	19.7%	18.0%
3.0-3.9%	10.8%	11.6%
4.0-5.0%	7.5%	8.7%
>5.0%	2.7%	6.4%

Basis: 147 captive and 172 job shop responses

Operating—Trucking and Hauling

Cost for trucking and hauling as a percentage of sales revenue is reported in Table 21 for all finishers.

REGULATORY COMPLIANCE COSTS

In the following sections data on personnel and the costs (operating and capital) related to compliance with regulations are summarized.

Capital

Total annual capital costs in 1996 and 1997 (estimated) for captive and job shops are shown in Tables 22 and 23. Nearly 50% of the captive shops and 40% of the job shops report annual expenditures below $10,000. The median and average for all finishers are $11,000 and $40,000 respectively.

Employees

The numbers of regulatory compliance related employees are shown in Table 24 for both captive and job shops. The median for captive shops is 3 to 4 and slightly less than 3 for job shops. From 20 to 30% of the shops indicate 0 to1 employees. This may be due to small shops having to rely on outside consultants rather than employees to assist with compliance-related activities. The averages for captive and job shops are 4 and 2.8 respectively.

Waste Treatment/Disposal Expenses

Annual waste treatment/disposal costs are shown as a function of sales revenue in Table 25. Nearly 30% of the captive shops were not able to respond, because the respondent was likely not aware of this cost, as it possibly is handled as a corporate function. Of the captive shops who did respond, the median was 2.2% and the average 2.5%. The median and average for job shops was 2.8%.

Table 22 Captive Shop Capital Expenditures for Regulatory Compliance

$1,000s	1996	1997
<10	45.4%	49.5%
10-30	22.2%	17.6%
30-50	12.0%	12.3%
50-100	8.7%	9.8%
100-200	5.3%	5.8%
>200	6.4%	5.0%

Basis: 207 and 204 responses

Table 23 Job Shop Capital Expenditures for Regulatory Compliance

$1,000s	1996	1997
<10	38.5%	40.6%
10-30	27.8%	29.7%
30-50	14.0%	12.5%
50-100	9.0%	9.2%
100-200	6.4%	4.0%
>200	4.3%	4.0%

Basis: 187 and 182 responses

Table 24 Employees Engaged in Compliance-Related Activities

Range	Captive Shops	Job Shops
0-1	20.3%	29.8%
2-3	37.0%	49.5%
4-6	22.7%	14.0%
7-10	10.0%	3.7%
>10	10.0%	3.0%

Basis: 216 captive and 188 job shop responses

Table 25 Waste Treatment Costs as a Percentage of Sales Revenue

	Captive Shops	Job Shops
<1%	20.0%	19.8%
1.0-1.9%	22.6%	18.7%
2.0-2.9%	24.5%	19.7%
3.0-3.9%	15.5%	14.0%
4.0-5.0%	8.4%	14.5%
>5.0%	8.4%	13.3%

Basis: 155 captive and 172 job shops responses

OSHA/Safety and Health Expenses

Annual OSHA safety and health compliance costs as a percentage of sales revenue are shown in Table 26. Due to a large number of nonresponses from captive shops, it is also likely (as with waste disposal) that these functions are handled corporately. Also due to the large number of very low percentages reported (40+% are less than 1%) by all finishers, this data is not very accurate. The median for all finishers of the reported data is about 1.4% and the average 1.65%.

Table 26 Cost of OSHA/Safety as a Percentage of Sales Revenue

	Captive Shops	Job Shops
<1.0%	31.6%	40.1%
1.0-1.9%	36.1%	33.1%
2.0-2.9%	21.0%	12.8%
3.0-3.9%	4.5%	7.0%
4.0-5.0%	3.8%	4.0%
>5.0%	3.0%	3.0%

Basis: 155 captive and 172 job shop responses

BASIC INFORMATION ON ANODIZING

Survey #4 was sent to 250 shops, which were thought to be anodizers. A total of 102 responses (40.8%) was received. As these surveys were being compiled, it was found that 18 did not conduct any anodizing operations. Thus the usable responses were reduced to 84 (33.6%). Of these 66 (78.6%) also operated electroplating processes.

Business Orientation

The respondents included 36 captive shops, 46 job shops, and 2 shops that indicated a combination of both. The latter were considered captive shops in compiling all results. The split was, therefore, 55% job shops and 45% captive shops conducting anodizing operations.

Employment

The employment levels for both captive and job shop anodizers are summarized in Table 27 with percentages for each range. There is a median of 23 and average of 65 employees for captive shops. The median employment for job shops is 45 with an average of 59. There is a large concentration of small captive anodizers with 10 or fewer employees. In general both the captive and job shop anodizers are larger employers than the platers who responded to the survey. This is likely reflected by the participation of firms in the architectural, airline/aerospace, and military industrial segments.

Facility Size

The distribution of anodizing factory sizes is shown in Table 28. The median captive shop operation is approximately 19,000 sq. ft., whereas the median job shop is indicated to be about 27,000 sq. ft.. The average captive shop is about 52,000 sq. ft. and the average job shop 37,000 sq. ft.. There appears to be a particularly large concentration of both small facilities (less than 10,000 sq. ft.) and very large

Table 27 Number of Employees Engaged in Finishing for Anodizing Facilities

Range	Captive Shops	Job Shops
1-10	31.6%	19.6%
11-20	15.8%	10.9%
21-30	13.2%	4.3%
31-50	7.9%	19.6%
51-75	5.3%	26.1%
76-100	5.3%	4.3%
101-200	5.3%	10.9%
>200	15.8%	4.3%

Basis: 38 captive and 46 job shop responses

Table 28 Anodizing Plant Floor Space

1,000 sq. ft.	Captive Shops	Job Shops
<10	29.8%	17.8%
10-20	21.6%	20.0%
20-30	8.1%	17.8%
30-50	8.1%	22.2%
50-100	8.1%	17.8%
>100	24.3%	4.4%

Basis: 37 captive and 45 job shop responses

facilities (greater than 100,000 sq. ft.). Anodizing facilities, in general, are larger than reported plating facilities. This is consistent with the employment levels above.

Industries Served

Table 29 lists the industry segments served by both captive and job shop anodizers. The defense/military/government segment is the highest. Computer/electronics, civilian aircraft, and machinery/industrial equipment follow. This is a considerably different market mix than that served by the automotive-dominated platers.

Table 29 Industries Served by Anodizers (Frequency of Top Three Selections)

	Captive Shops	Job Shops
Automotive/Truck, OEM	13%	24%
Building/Construction	5%	13%
Civilian Aircraft/Aerospace	29%	43%
Computer/Communication Electronics	21%	41%
Defense/Military/Govt.	47%	50%
Furniture/Fixtures	11%	9%
Machinery/Industrial Equipment	24%	48%

Basis: 38 captive and 46 job shop responses; captive shops tend to list only 1 or 2

Processes Employed

The anodizing processes employed by both captive and job shops are shown in Table 30. Chromic acid anodizing is most common for captive shops (suggesting airline/aerospace and military applications) while decorative anodizing leads for job shops.

Table 30 Anodizing Processes in Use

	Captive Shops	Job Shops
Chromic Acid	53%	46%
Decorative	37%	80%
Hard Coat	39%	57%
Titanium	0%	4%

Basis: 38 captive and 46 job shop responses

Table 31 1996 Anodizing Plant Sales Volume

$ Millions	Captive Shops	Job Shops
<0.5	29%	11%
0.5-1.0	17%	20%
1.0-2.0	13%	13%
2.0-3.0	0%	13%
3.0-5.0	4%	22%
5.0-7.0	4%	5%
7.0-10.0	8%	5%
>10.0	25%	11%

Basis: 24 of 38 captive and 45 job shop responses; 14 captive shops reported unknown

ECONOMIC OUTLOOK FOR ANODIZERS

Sales Volume

The 1996 sales volumes for captive and job shop anodizers are summarized in Table 31. The large concentration of both small and very large captive shops is illustrated in the table. The median captive shop sales level is about $1.3 million with an average annual sales revenue of $5.2 million. Of the captive shops reporting 37% indicated that revenue value was unknown. This situation is similar to that experienced with other finishers.

The median annual job shop sales volume is about $2.3 million with an average of $4 million per company. Anodizing sales revenues for job shops were slightly larger than for plating.

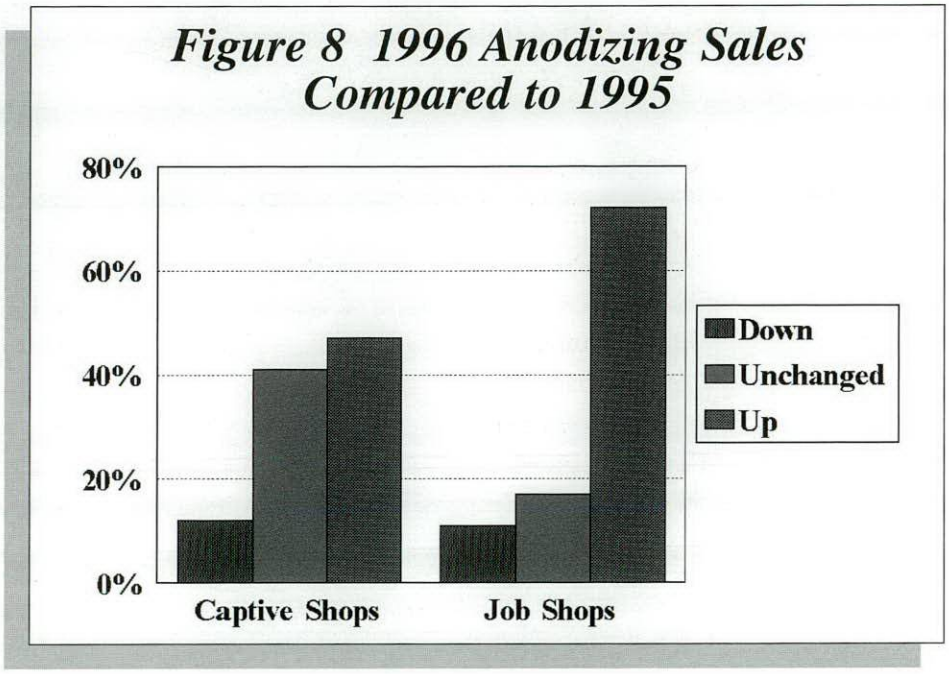
The captive shop data indicate an average sales level of $80,000 per employee, which is consistent with that reported for plating operations. The job shop data indicate an average of about $68,000 in sales revenue per employee, which is slightly lower than that reported by job shop platers.

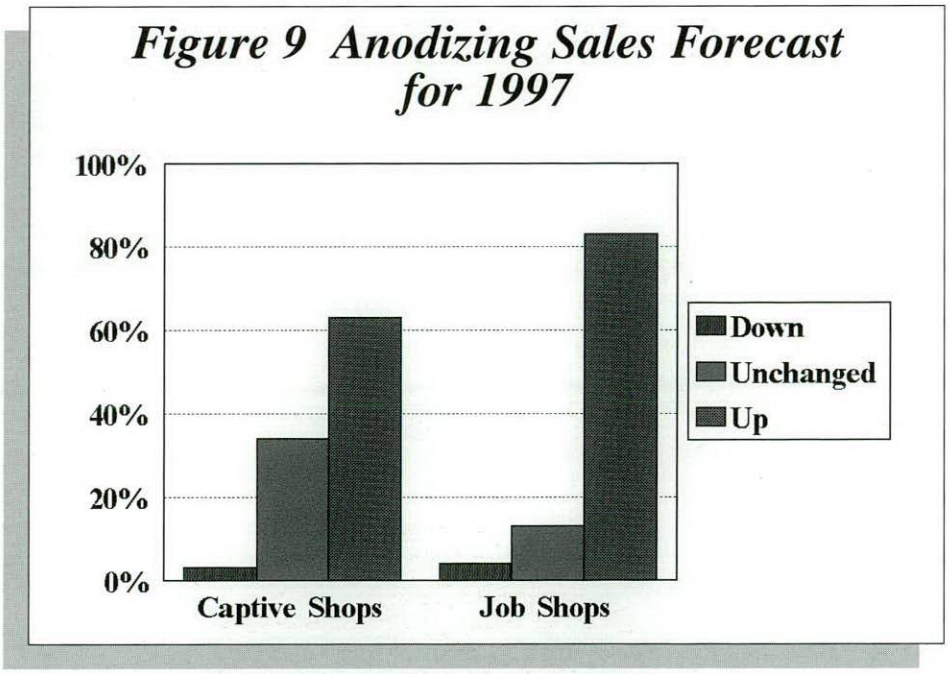
Business Trend

A comparison of 1996 sales revenue with 1995 is shown in Figure 8. Over 70% of anodizing job shops reported an increase in year-to-year sales, whereas only about 50% of captive shops reported increases. Only about 10% of all anodizers reported revenue decreases in 1996 compared to 1995.

Business Forecast

Over 60% of the captive anodizing shops and more than 80% of the job shop anodizers expected an increase in business for 1997 (see Figure 9). Less than 5% of all anodizers anticipate a loss in business volume for 1997. This is more optimistic than the outlook for finishers in general.





RESOURCE RECOVERY

Survey #1 was mailed to 1,000 captive and job shops engaged in plating and anodizing operations (8,866 on list). It posed questions related to uses of resource recovery techniques. The data from the 241 usable responses are reported in this section. In general it can be stated that resource recovery can be considered an integral, important part of today's electroplating production process.

Techniques

Of the 241 responses, 126, or 52.3%, indicate that they now practice some sort of resource recovery.

Table 32 Resource Recovery Techniques in Use

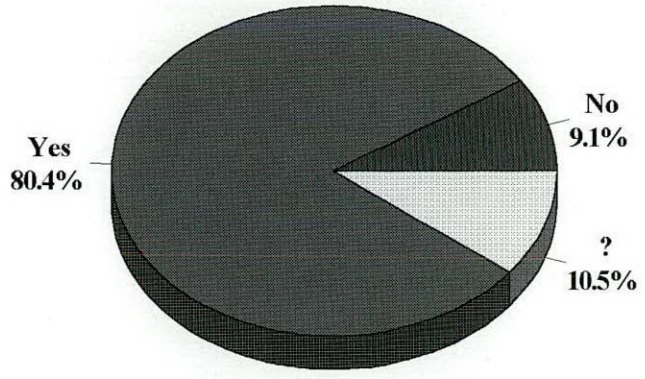
Process	Percent
Atmospheric Evaporation	42.9%
Diffusion Dialysis	2.4%
Electrodialysis	7.1%
Electrowinning	21.4%
Ion Exchange	35.7%
Micro/Ultrafiltration	20.6%
Reverse Osmosis	15.1%
Vacuum Evaporation	14.3%
Others	13.5%

Basis: 126 users of resource recovery, some with more than one process

The techniques currently in use and the percentage of each in use is summarized in Table 32. Of significance atmospheric evaporators are used by more than 40% and ion exchange by more than 35% of those employing recovery. There was no provision made to further identify the processes used by those who checked "Others." A few items were written onto the form including electrocoagulation for general rinsewaters and precipitation to recycle spent caustic aluminum etchants.

The overall cost effectiveness of resource recovery techniques used for specific processes is summarized in Figure 10. On average these techniques have proven to be successful for more than 80% of users.

Figure 10 Is Resource Recovery Cost Effective?



Basis: 229 responses

Applications

There are many plating processes where resource recovery is used. The percentages of each technique used with various process operations (minimum of 10 users) are summarized in Table 33. This is a further illustration of the broad use of ion exchange and atmospheric evaporators.

Table 33 Resource Recovery Process Applications

	AE	DD	ED	EW	IX	MF	RO	VE	CO
Hexavalent Chromium	31%				31%			15%	23%
Trivalent Chromium	36%		7%		50%				7%
Cyanide Copper	44%			6%	18%	13%		6%	13%
Acid Copper	20%	7%		26%	33%	7%			7%
Gold	12%			29%	35%				24%
Electroless Nickel	10%		10%		40%		10%		30%
Sulfamate Nickel	39%		6%		22%		11%	6%	16%
Watts Nickel	59%			5%	27%			9%	
Silver	19%		6%	31%	6%				38%
Acid Zinc	77%								23%
Chromating	27%				27%	9%	9%	9%	19%
General Rinse	18%				27%	12%	18%	3%	22%

AE Atmospheric Evaporation
DD Diffusion Dialysis
ED Electrodialysis
EW Electrowinning
IX Ion Exchange
MF Micro/Ultrafiltration
RO Reverse Osmosis
VE Vacuum Evaporation
CO Combination

The cost effectiveness rating for the use of resource recovery with each of these processes is summarized in Table 34.

Rinsewater Conservation

The most popular water saving techniques used by those employing resource recovery are shown in Table 35. Drag out and counterflow rinsing are the most popularly applied techniques, used by 63% and 51% respectively.

The techniques reporting the highest degrees of success are shown in Table 36. It is not surprising then that these methods seem to agree fairly well with the methods that are the most popular as listed in Table 35.

Sludge Disposal

Landfill sludge disposal is reported to be practiced by 65.1% of finishers while 34.9% report the use of smelters. The SFMRB received an inadequate response to a further question requesting details on the type of smelter but the majority appear to use pyrometallurgical processors.

Table 34 Cost Effectiveness of Resource Recovery Techniques for Various Processes

Process	Cost Effectiveness
Trivalent Chromium	93%
Hexavalent Chromium	83%
Acid Copper	87%
Cyanide Copper	88%
Gold	77%
Electroless Nickel	80%
Sulfamate Nickel	72%
Watts Nickel	83%
Silver	81%
Acid Zinc	92%
Chromates	82%
General Rinse	76%

Table 35 Most Popular Water Saving Techniques

Method	Usage
Drag-Out Tank	80%
Counterflows	64%
Air Agitation	57%
Fog/Spray	48%
Wetting Agent	45%
Rinse Control	41%

Basis: Users of resource recovery

Table 36 Most Successful Water Saving Methods

- **Increase number of counterflows**
- **Add drag-out tanks**
- **Up rotation for barrels**
- **Rinse controllers**
- **Fog-spray rinses**

Barriers to Use

Perceived barriers to implementation of resource recovery techniques for both present resource recovery users and nonusers are summarized in Table 37. It is not surprising that capital cost is the major barrier for nonusers; however, the large number (47%) reporting operation and maintenance

Table 37 Barriers to Implementation of Resource Recovery Methods

	Capital Cost	O & M Cost
Current Users	23.8%	18.3%
Nonusers	66.1%	47.8%
All	48.1%	32.4%

(O&M) costs as a barrier seems surprisingly high. Some additional reasons listed for not implementing resource recovery were:

- Too small an operation
- Lack of technical expertise/personnel
- Inability to market recovered materials
- Not applicable to existing processes.

Availability of information on resource recovery does not seem to be a factor that affects implementation. A little more than half of both users and nonusers report that there was enough information available. Lack of information does not seem to have hampered utilization of resource recovery techniques. This indicates that finishers are willing to investigate and try new methods to achieve compliance and reduce costs.

Effect on Plant Operations

Most users of resource recovery techniques (60%) report that plant operations were not affected. Some of the operational changes that were required by implementation of resource recovery methods included:

- More frequent filtration
- More frequent carbon treatment
- Increased equipment maintenance
- More operator training required.

Over 90% of resource recovery users report that final work quality was not affected. Some other benefits that were reported by users included:

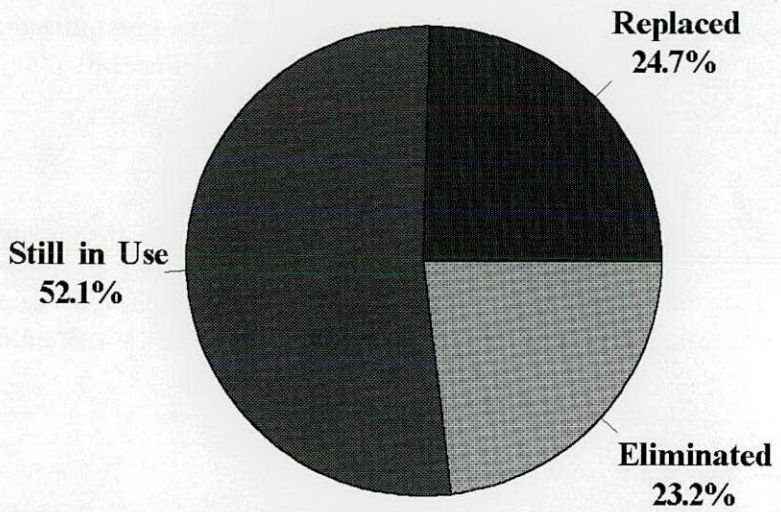
- Better performance of process baths
- Less rinsing problems
- Increased product quality
- Increased worker safety due to fewer chemical additions
- Fewer problems with EPA

- Spent acid used by another firm
- Better plant image
- Cost of operation reduced
- Better relations with city
- Elimination of wastewater discharge fees.

SUBSTITUTION/ELIMINATION OF CHROMATES/CYANIDES

In addition to soliciting information on the use of resource recovery techniques used by metal finishers, Survey #1 requested data on the substitution or elimination of various processes using hexavalent chromium and cyanide. Figure 11 summarizes the 375 responses from users or past users of hexavalent chromium containing processes for chromium plating, chromic acid anodizing, chromate conversion coatings, and chromate containing bright dips for brass and copper. About 50% of the operations continue to use hexavalent chromium with the remainder split evenly between those who have found substitutes and those who have simply eliminated the process. A number of the respondents indicated that although eliminating a process in-house, the operation was continued through outsourcing. Some replacements were based on changes in raw materials.

Figure 11 Elimination/Substitution of Hexavalent Chromium Containing Processes



Basis: 375 responses including chromic acid anodizers, chromium platers, etc.

Tables 38 to 41 provide details on replacement/elimination of hexavalent chromium from various processes. Each table gives the percentage of processes that continue to utilize hexavalent chromium, the portion replaced (with data on the replacements used), and the number who have discontinued the operation. For example, Table 38 shows that 59% continue to use hexavalent chromium for industrial or hard chromium plating with 21% reporting replacements and 20% dropping the operation. Electroless nickel (12%) and electroplated nickel alloys (7%) were the most reported replacements.

Table 38 Replacement/Elimination of Hexavalent Hard Chromium Plating Processes

Status	Replacement Rate	Overall Percentage
Still in Use		59%
Replaced by:		
Electroless Nickel	*12%*	
Nickel Alloys	*7%*	
Other	*2%*	
Total Replaced	*21%*	21%
Dropped		20%

Basis: 76 responses

Table 39 Replacement/Elimination of Hexavalent Decorative Chromium Plating

Status	Replaement Rate	Overall Percentage
Still in Use		48%
Replaced by:		
Trivalent Chromium	*13%*	
Nickel Alloys	*4%*	
Cobalt Alloys	*1%*	
Total Replaced	*18%*	18%
Dropped		33%

Basis: 75 responses

Table 39 provides similar information for decorative chromium, for which the most popular substitute was trivalent chromium plating. This process is not yet considered commercially satisfactory for replacement in hard chromium plating. Sulfuric acid anodizing was the only choice reported for replacement of chromic acid anodizing as seen in Table 40. Table 41 provides data relating to chromate conversion coatings. Trivalent chromium coatings are the overwhelming choice as substitutes; and only 1% report dropping this process. A range of replacements for chromic acid bearing bright dips for brass and copper is reported in Table 42 including the use of hydrogen peroxide/sulfuric acid, mechanical finishing (polishing and buffing), and electropolishing.

Table 40 Replacement/Elimination of Chromic Acid Anodizing

Status	Replacement Rate	Overall Percentage
Still in Use		35%
Replaced by:		
Sulfuric Acid	*18%*	
Total Replaced	*18%*	18%
Dropped		47%

Basis: 51 responses

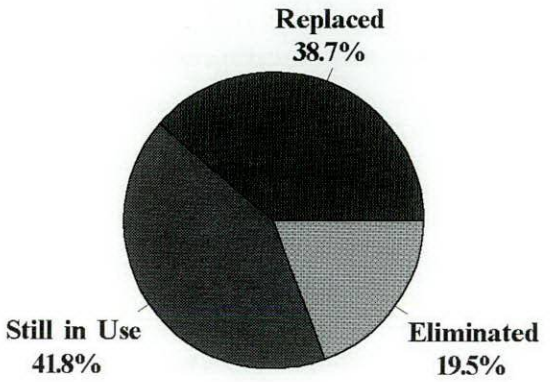
Table 41 Replacement/Elimination of Chromate Conversion Coatings

Status	Replacement Rate	Overall Percentage
Still in Use		71%
Replaced by:		
Trivalent Chromium	*23%*	
Phosphate	*2%*	
Organic Coating	*2%*	
Other	*1%*	
Total Replaced	*28%*	28%
Dropped		1%

Basis: 102 responses

Figure 12 summarizes the results of the survey concerning substitution/elimination of cyanide-based processes for electroplating of cadmium, copper, and zinc. Approximately 40% are still in use, with 40% replaced and 20% eliminated. Tables 43 to 45 provide details. Zinc or zinc alloy plating processes are the primary alternatives for cadmium (Table 43), which has seen a drop-off of 35% in use. Nearly 70% of zinc cyanide plating processes have been replaced with the acid zinc and alkaline non-cyanide alternatives predominant. Replacements for cyanide copper (acid copper and alkaline non-cyanide copper) have proven less popular.

Figure 12 Elimination/Substitution of Cyanide-Based Process Solutions



Basis: 256 responses from cadmium, copper, and zinc platers

Table 42 Replacement/Elimination of Chromic Acid Containing Bright Dips

Status	Replacement Rate	Overall Percentage
Still in Use		34%
Replaced by:		
Peroxide/Sulfuric Acid	*18%*	
Electropolishing	*7%*	
Mechanical Finishing	*6%*	
Other	*4%*	
Total Replaced	*35%*	35%
Dropped		31%

Basis: 71 responses

Table 43 Replacement/Elimination of Cadmium Cyanide Plating Processes

Status	Replacement Rate	Overall Percentage
Still in Use		37%
Replaced by:		
Zinc Plating	*18%*	
Zinc Alloy Plating	*6%*	
Other	*4%*	
Total Replaced	*28%*	28%
Dropped		35%

Basis: 71 responses

Table 44 Replacement/Elimination of Zinc Cyanide Plating Processes

Status	Replacement Rate	Overall Percentage
Still in Use		25%
Replaced by:		
Acid Zinc	*30%*	
Alkaline Non-CN Zinc	*37%*	
Low-CN Zinc	*4%*	
Paint	*1%*	
Total Replaced	*72%*	72%
Dropped		3%

Basis: 90 responses

Table 45 Replacement/Elimination of Copper Cyanide Plating Processes

Status	Replacement Rate	Overall Percentage
Still in Use		62%
Replaced by:		
Acid Copper	*7.5%*	
Alkaline Non-CN Copper	*7.5%*	
Total Replaced	*15%*	15%
Dropped		23%

Basis: 95 responses

Table 46 Cleaning Product Form Used for Cleaning/Pretreatment

Form	Paint/Powder Coating	Plating
Powder	15.5%	28.3%
Liquid	53.2%	20.3%
Both	31.3%	51.4%

Table 47 Annual Expenditure for Plating Cleaning and Pretreatment

Range	Number
<$10,000	36.8%
$10-49,000	36.3%
$50-100,000	16.1%
>$100,000	10.8%

Basis: 223 plating shops

Table 48 Annual Expenditure for Paint/Powder Cleaning/Pretreatment

Range	Number
<$10,000	30.0%
$10,000-35,000	32.3%
$36,000-75,000	16.0%
$76,000-200,000	12.9%
>$200,000	8.8%

Basis: 387 paint/powder shops

CLEANING/PRETREATMENT PRACTICES

This section will summarize the results from Surveys #1 and #2 relating to cleaning and pretreatment practices for both plating shops and painting/powder coating shops that conduct pretreatment. There is more extensive information from the painters/powder coaters because the questionnaire to platers also covered the resource recovery and substitution of chromates/cyanides reported above.

Product Form

Table 46 gives the form (liquid, powder, or both) in which the respondents purchase their cleaning/pretreatment chemicals. More than 50% of the paint/powder pretreatment materials and 20% of the plating pretreatment materials are obtained exclusively as liquids. Powders were used exclusively by 28.3% of the platers and only 15.5% of the painters/powder coaters. It appears, based on historical observations, that liquids are gaining in popularity due to the advantages in product handling, dosage, and consistency.

Pretreatment Material Costs

Annual expenditures for cleaning/pretreatment materials are given in Tables 47 and 48 respectively for plating and painting/powder coating. The median response for platers was $24,000 and the average was $38,000, or approximately 1% of annual facility sales revenue. The median expenditure for painters/powder coaters was $25,000 and the average was $66,000.

Table 49 Discharge Limits Imposed on Plating Shops for Various Materials

Material	Currently	Expected
Phosphates	26.1%	2.1%
Boron or Borates	11.6%	2.1%
Fluorides	18.3%	2.9%
Silicates	14.5%	2.1%
Molybdenum	13.7%	2.1%
Iron	30.3%	3.7%
Chelates	17.0%	2.9%
Oils	53.9%	1.7%

Basis: 241 plating shops

Discharge Limits

Requirements from regulatory agencies to reduce or eliminate ozone depleting solvents have led to a broader reliance on aqueous cleaning. Reformulation of these materials as well as the need to meet new application demands has resulted in upsets to in-plant waste treatment systems and increased scrutiny by regulatory agencies. It was, therefore, of interest to determine the status of wastewater discharge limits on a variety of substances that have been or might be incorporated into cleaners or pretreatment chemicals. Tables 49 and 50 report survey results for these substances.

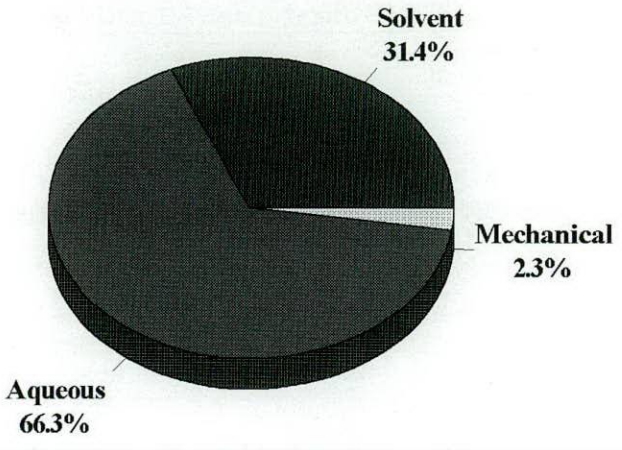
The most frequently mentioned regulated materials were similar for both groups, except that phosphates affected two-thirds of the painters/powder coaters and only one-quarter of the platers. This is understandable, since the majority of painters/powder coaters use phosphates while only 23% of captive plating shops and 21% of job shop platers do so (see Table 11). Oils and iron were high for both

Table 50 Discharge Limits Imposed on Paint/Powder Shops for Various Materials

Material	Currently	Expected
Phosphates	67.3%	7.0%
Boron or borates	23.4%	3.2%
Fluorides	30.4%	2.0%
Silicates	27.5%	2.3%
Molybdenum	24.6%	4.1%
Iron	46.2%	5.3%
Chelates	21.1%	2.9%
Oils	64.9%	7.9%

Basis: 342 paint/powder shops

Figure 13 Cleaning Replacements Selected by Plating Shops



groups. Other items (borates, fluorides, silicates, molybdenum, and chelates) were noted by 20 to 30% of painters/powder coaters, but were insignificant for platers.

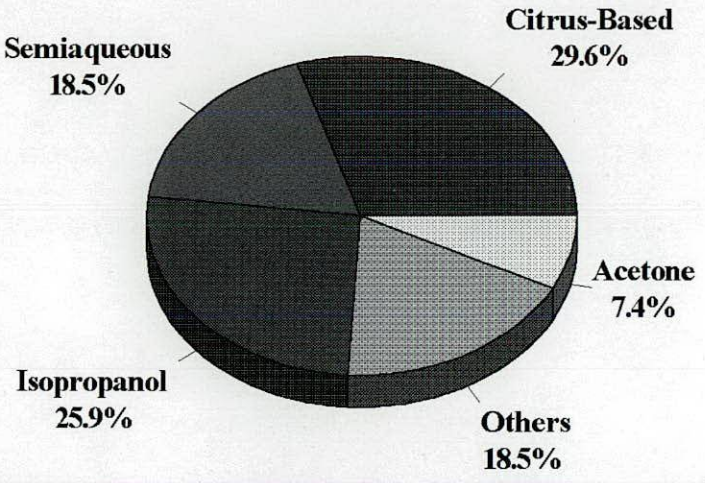
PLATING PRETREATMENT

Chlorinated Solvent Replacement

Regulatory concerns have put enormous pressure on all operations using chlorinated solvents for cleaning. The current survey indicates that 73.8% of plating operations have replaced their chlorinated solvents with more environmentally responsible alternatives. This trend is expected to continue as new products are developed, which meet the needs of those operations still forced to use these solvents due to particular product demands.

Two-thirds of the facilities that have replaced chlorinated solvents have switched to aqueous cleaning methods (see Figure 13). The majority of the balance chose alternate solvents. Mechanical methods of cleaning (blasting, etc.) are a minor factor. The solvent alternatives to environmentally harmful materials are shown in Figure 14. There is a broad spectrum of choices with citrus-based materials and isopropanol leading the way. As aqueous cleaning materials and methods continue to develop, a decrease in the solvent alternative use is expected.

Figure 14 Nonchlorinated Solvent Alternatives Selected by Plating Shops



Substrates Cleaned

Based on responses to the pretreatment questionnaire (see Table 51), the most popular substrate requiring cleaning is steel. More than half of all respondents indicated that steel represents more than 50% of the material that they clean. Other popular substrates are copper/brass and aluminum alloys. Plastic materials appear to be decreasing in usage.

Table 51 Primary Substrate Processed in Plating Shops

Material	Number Using
Aluminum Alloys	13.5%
Copper & Brass	16.2%
Plastic	1.6%
Stainless Steel	7.8%
Steel	51.6%
Zinc Die Casts	4.7%
Other	4.7%

Others: ceramic, nickel, titanium

Table 52 Employment Levels in Plants Conducting Paint Pretreatment

Range	Number	Percent
<25	243	62.3
26-50	77	19.7
51-100	43	11.1
>100	27	6.9

PAINTING/POWDER COATING PRETREATMENT

Employment Levels

Table 52 summarizes the employment levels in painting and powder coating plants conducting pretreatment. Over 60% employ less than 25 people. The median number of employees was 20 and the average 32.

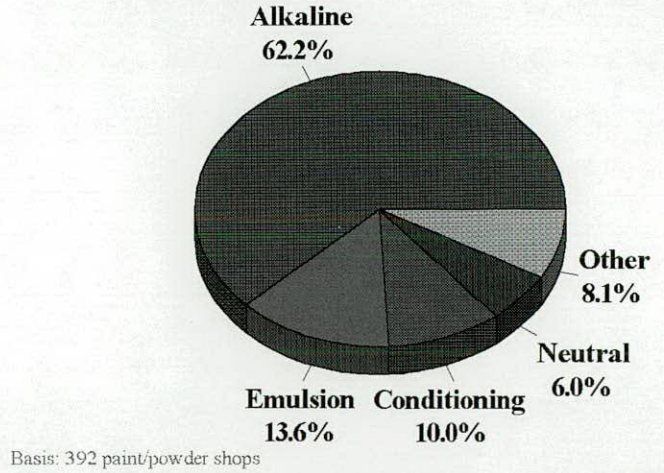
Cleaners

The types of cleaners used in paint/powder pretreatment are reported in Figure 15. Aqueous alkaline cleaners are clearly predominant with 62% usage.

Conversion Coatings

The breakdown of conversion coating types used in paint/powder coating pretreatment is given in Table 53. As expected, iron phosphate is the most popular. The bulk of the substrates processed is steel with most of the balance being aluminum alloys.

Figure 15 Types of Cleaners Used in Paint/Powder Pretreatment



Basis: 392 paint/powder shops

Table 53 Types of Conversion Coatings Used for Paint/Powder Pretreatment

Process	Percent of Lines Using
Manganese Phosphate	2.8%
Iron Phosphate	36.8%
Cleaner Plus Phosphate	16.7%
Heavy Zinc Phosphate	2.2%
Zinc Phosphate	15.1%
Calcium Modified	1.1%
Cobalt Modified	1.2%
Chromium Phosphate	1.3%
Chromate	11.3%
Nonchromate	6.7%
Anodizing	4.7%

Seals

Table 54 summarizes the types of phosphate seal rinses employed by painting and powder coating shops. The most common are deionized water and nonchromium containing materials. Use of hexavalent chromium bearing seals is obviously on the decline.

Water

The extent of purified water use and consideration for future application are shown in Table 55 along with the type of process utilized for obtaining it. Deionization is the method of choice.

Table 54 Types of Seals Used

Sealing Process	Percent of Lines
Deionized Water	29.9%
Nickel	3.6%
Trivalent Chromium	5.1%
Hexavalent Chromium	10.8%
Nonchromium	31.2%
Other	19.4%

Table 55 Extent of Purified Water Use in Paint/Powder Pretreatment Processes

Type	Currently Using	Considering Use
Deionized	34.7%	11.7%
Distilled	1.5%	1.0%
Reverse Osmosis	7.9%	7.9%
Softened	14.4%	6.0%
Other	8.4%	1.7%

Paints and Powder Coatings

The consumption of liquid primers and topcoats for respondents is presented in Table 56. Table 57 provides the consumption of powder coatings. Some shops reported in both categories, others in neither.

Equipment

The types of equipment used for paint/powder coating pretreatment are given in Table 58. Spray methods clearly dominate with over 50% reporting use of this technique and an additional 11.3% using a combination of immersion and spray. The number of lines operated is reported in Figure 16. As the majority of respondents is small, it is not surprising that most have only one line. The median

Table 56 Consumption of Primers and Topcoats

Gallons per Day	Number
<5	20.9%
5-15	23.0%
16-50	23.6%
>50	32.4%

Table 57 Consumption of Powder Coatings

Pounds per Day	Number
<20	14.4%
21-100	32.6%
101-500	35.8%
>500	17.1%

Table 58 Equipment Used for Paint Cleaning/Pretreatment

Type	Number of Lines	Percent
Spray	362	54.4
Immersion	160	23.9
Combination	75	11.3
Spray Wand	51	7.7
Other	18	2.7
Total	**666**	**100**

Table 59 Number of Stages in Pretreatment

Number of Stages	Percentage of Lines
2	21.2%
3	25.5%
4	9.1%
5	20.4%
6	5.2%
7	9.0%
>7	9.6%

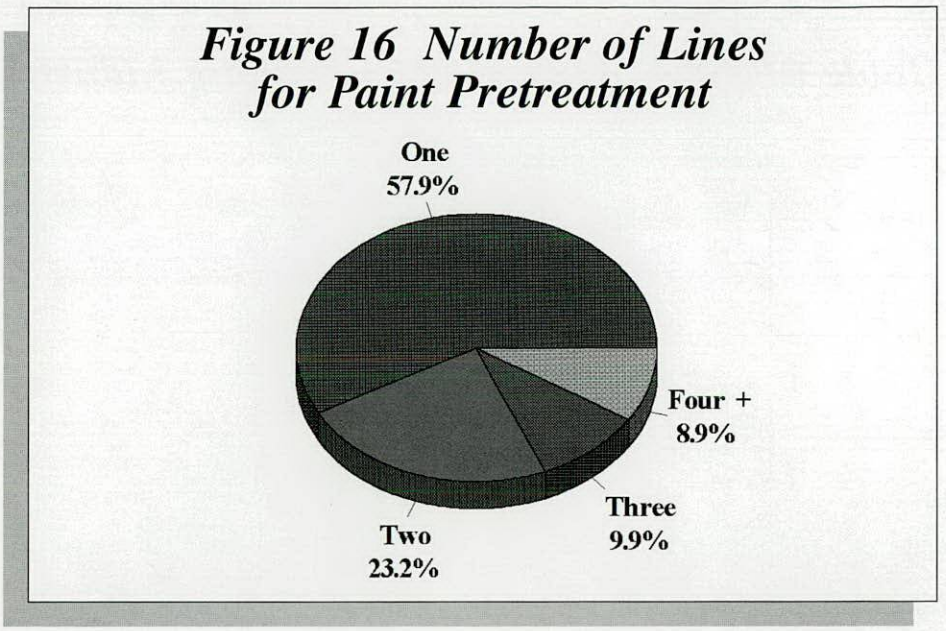
Table 60 Extent of Recycling for Paint Cleaning/Pretreatment Processes

Process	In Use	Planned
Filtration	42.0%	10.4%
Ultrafiltration	14.4%	3.2%
Microfiltration	5.2%	1.2%
Reverse Osmosis	5.7%	2.7%

Basis: 364 paint/powder shops

is one line and the average 1.5 lines. The number of stages used for pretreatment is provided in Table 59. This may be somewhat misleading since no attempt was made to distinguish between different processes. The outcome for iron phosphate will surely be considerably different when compared, for example, to anodizing.

The extent of cleaner/pretreatment recycling is reported in Table 60. Filtration is becoming a very common practice.



SIZE OF METAL FINISHING INDUSTRY

The past two SFMRB reports included an estimate of the size of the metal finishing industry in the U.S. In this section, an update of this estimate will be provided using those portions of the data, which have been refined in this report. In summary the metal finishing industry today involves about 10,000 companies engaged in plating, anodizing, and printed circuit fabrication with approximately 500,000 employees, generating an annual $48 billion in revenue, which generates an annual gross domestic product contribution of about $40 billion to the U.S. economy.

The SFMRB believes that this year's survey includes more accurate employment and sales data for captive and job shops than previous reports. This year's data are summarized in Table 61. The total number of metal finishing shops is currently estimated as 9,000, divided as 4,700 captive and 4,300 job shops.

The printed circuit board data were confirmed by the Institute of Printed Circuits. The total sales of materials were estimated from a combination of this survey and past reports. The equipment sales estimates come entirely from past reports. The sales of materials and equipment to finishing shops were eliminated to prevent double counting; therefore, the final estimate of $40 billion in revenue. This is smaller than reported two years ago.

The job shops responded that 19.3% of sales revenues were for materials. Captive shops reported material expenses at 17.7% of revenue. A value of 18% was used for circuit board shops. These data were used to establish that total materials purchased were about $7 billion.

Table 61 Size of the Metal Finishing Industry

Category	Companies	Employees	Sales per Employee, $	GDP Contribution, $ Billion
Captive Shops	4700	220000	76000	17
Job Shops	4300	210000	75000	16
Circuit Board Shops	700	70000	100000	7
Total Finishers	9700	500000		40
Materials	400	18000	400000	7
Equipment	100	2000	350000	1
Total Suppliers	500	20000		8
Grand Total	**10200**	**520000**		**48**

Based partially on previous SFMRB reports

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Curtis Goad	Goad Co.
Beverly Graves	*Products Finishing*
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SFMRB METAL FINISHING INDUSTRY MARKET SURVEY

1993-1994

ENDORSED BY:

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EXECUTIVE SUMMARY

In recognition of the need for statistical information on the metal finishing industry, the American Electroplaters and Surface Finishers Society (AESF), the Metal Finishing Suppliers' Association (MFSA) and the National Association for Metal Finishers (NAMF) have joined to form the Surface Finishing Market Research Board (SFMRB).

Representatives of the sponsoring organizations form the membership of the SFMRB, which met to discuss methods to gather the data of interest. It was determined that questionnaires would be used to survey the various industry components. In September 1993, the initial series of survey questionnaires was distributed. An initial report was presented at the joint meeting of MFSA/NAMF/AESP held in March of 1994. This report summarizes the results of the second survey conducted by the SFMRB in late 1994 and early 1995.

The SFMRB, with the cooperation of all the key industry associations and trade journals, created a comprehensive, merged mailing list of metal finishers and metal finishing suppliers. Two simplified survey forms were designed by the committee to obtain information from: 1) job shop and captive finishers; and from 2) material and equipment suppliers. The forms were mailed in January, 1995. A system to maintain confidentiality of all information was designed using a CPA firm. A total of 352 usable completed survey forms were received.

Statistically significant reported data was used to calculate scaled-up industry results. The key findings of the analysis of the survey data, related only to the metal finishing industry, are:

- The metal finishing industry has an annual sales turnover of several tens of billions of dollars.
- A strong majority of the metal finishing industry believes business will improve in 1995/6 and a small minority thinks it will be worse.
- The total metal finishing industry is estimated to employ 22% fewer people, but with a higher annual sales turnover than in the initial report.
- Average factory sizes for suppliers are indicated to be about the same as in the initial survey, but are indicated to be significantly smaller for job shop finishers.
- The average number of job shop finisher and supplier employees is slightly lower than the initial report. However, the average number of captive finisher employees is significantly lower than in the initial report.
- The average job shop sales revenue and revenue per employee increased slightly over the initial survey by an amount about equal to inflation. Captive sales revenue per employee is much higher while the average number of employees is down. Also, since the role of distributors was factored into this current survey for the first time, the averages for supplier sales revenue and sales per employee are significantly higher than the initial report.

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- The average line plates slightly less than the square footage the in the initial report. Mild and hard steel are still indicated to be the dominant substrates plated. Copper alloys and plastics area plated showed a reduction while aluminum and zinc showed increases over the initial survey.

- The average number of plating lines per facility and the percentages of manual vs automatic remained virtually unchanged from the initial survey. There was, compared to the initial survey, a dramatic increase in the use rack plating and a large decrease in the use of barrel plating. However, this may also be just an improvement in the initial survey's limited statistics.

- The total number of North American plating facilities (captive and job shop) is indicated to be slightly higher than the initial report , but employing about 20% less people. The overall sales turnover was shown to be much larger.

- The automotive end use market segment demand is the largest followed by consumer durables and the defense/military.

- The metal finishing material and equipment suppliers are estimated to employ fewer people with a higher gross domestic product contribution than the initial report.

- Job shop current reported percentage costs as compared to the initial report are to:

  —Labor - higher
  —Material - much higher
  —Environmental - much higher
  —Safety and Health - higher

- The participation by the job shop finshers was significantly higher than in the initial survey. The supplier participation was lower.

In future years, broader cooperation from all segments of the metal finishing industry will be encouraged to enable the SFMRB to report improved, more comprehensive, and more accurate data on the metal finishing industry.

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STATUS OF THE INDUSTRY

The metal finishing industry in North America has been faced with dramatic economic, technical and regulatory challenges in recent decades. An industry under diverse pressures needs basic statistical information to know where it stands and to guide its future course. The Surface Finishing market Research Board (SFMRB) was created to meet that need.

The concept for the SFMRB was first born in April, 1991 within the Metal Finishing Suppliers' Association (MFSA). Following a series of meetings, and with great assistance from the Institute for Interconnecting and Packaging Electronic Circuits (IPC), the Boards of the American Electroplaters and Surface Finishers Society (AESF), the MFSA and the National Association of Metal Finishers (NAMF) were presented with a request for funding, based on the use of survey forms. MFSA and NAMF approved the funding requests, and formally announced the formation of SFMRB in 1993, with AESF joining in the funding slightly later.

The success of the initial report, presented at the joint MFSA/NAMF/AESP conference in March of 1994, led to the preparation of this current report, which further develops and refines the data. It is expected that the information developed will help both metal finishers and their suppliers make better decisions regarding areas for business development. It should also provide the industry with more detailed information regarding employment and commercial activity for use in presentation to governmental and regulatory bodies.

The results of this second segment of the project are being presented at the NAMF Outlook session at AESF's SUR/FIN '95 in Baltimore, June 26-29, 1995.

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METHODOLOGY

After the initial SFMRB report was presented, a new slate of board representatives from the AESF, MFSA and NAMF was formed. The committee first met in March of 1994 at Hilton Head, during the MFSA/NAMF Joint Conference to begin implementation of the plans for the second survey, approved by the respective boards. Howard Smith (Atotech USA) was designated as committee chairman and David Lucas (D. K. Lucas & Associates, Jensen Beach, Florida) as coordinating consultant. It was established that several surveys would be conducted. The main two questionnaires were designed to permit scale-up of the data and crosschecking between users and suppliers. These were to be distributed by mail. The two main survey groups were included in the mailings:

1) Job shop and captive finishers; and
2) Suppliers of equipment and materials.

All data received by SFMRB are treated as confidential. Individual companies return completed forms to a CPA, who then removes all identifying information and codes each response. Participants submitting usable forms receive a summary of the results from their questionnaire from the CPA. For this purpose the CPA retains a listing of the participants.

The purpose of the questionnaires was to provide information that would determine the size of the industry in terms of number of installations, the number of employees at these locations, processes used, sales values, market segments served and other related data. Technology and market trends, costs for labor, materials, pollution control, OSHA, etc. would also be explored.

In order to obtain the most complete mailing list possible, the three funding trade associations and the major trade publications participated by contributing the use of their mailing lists. Metal Finishing , Products Finishing and Finishers Management agreed to supply their lists, as did the American Society for Electroplated Plastics (ASEP). The lists were supplied to a bonded mailing house along with those of AESF, MFSA, and NAMF. Duplicate entries were eliminated where possible. Separate supplier and finisher lists were generated. Mailings were then made in January of 1995 to the complete merged lists in both categories.

Respondants in the U.S.A. and Canada were asked to supply information related to electroplating, electroless plating, cleaning, conversion coating, stripping and printed circuit board fabrication; but not painting, powder coating, coil coating and vacuum coating operations.

All finishers and suppliers were asked to supply metal finishing related sales and employment data for 1993 and 1994. The finishers were requested to provide data on processes and equipment used, while the suppliers were asked to provide details on sales of equipment, chemicals and materials in various categories. Also suppliers were asked to separate their direct sales and sales to distributors, to eliminate the possibility of double counting.

The basic assumption behind the planned use of these statistics was to have a three-way crosscheck. First a postcard was inserted into the trade publications to solicit economic data for eight commonly used finishing processes. Subsequently, if at least 25 shops submitted user statistics via the postcard for any single process, one could assume a meaningful average was obtained based on a normal dis-

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tribution of results. If the universe (i.e., total industry use) of proprietary chemicals, chemical salts or anodes is known, then it should be possible to scale up to the total industry activity for that process. If all three scaling factors are known, up to three estimates of the industry totals are possible. This logic implied the need for the SFMRB to achieve nearly complete cooperation of the consumable suppliers and broad response from shops using the various processes. Unfortunately, the postcard data response was insufficient and thus the data obtained during the initial survey was used.

The following table gives details on the size of the merged mailing list for each category, the total number of responses, and the number of usable responses for each of the categories. A usable response was simply one that contained sufficient information to be worthy of tallying. A comparison with the initial survey is also shown.

MAILING LIST/REPONSES

	JOB SHOPS/ CAPTIVES	SUPPLIERS [1]
TOTAL IN LIST	14258	1735
PERCENT MAILED OUT	100%	100%
USABLE RESPONSES	383	69
PERCENT USABLE	2.7%	4.0%
INITIAL SURVEY	2.3%	4.8%

[1] SUPPLIERS INCLUDES DISTRIBUTORS

Follow up mailings and phone calls were conducted to improve the volume of usable responses. Typical industry responses to mail surveys of this type range from 1.5 to 6%, so the results were within the acceptable range. The simplified process data questions in this year's form significantly improved the response rate from job shops. However, the request for a breakout on distributor sales caused the quantity of supplier responses, particularly material suppliers, to be reduced (1.9% vs 3.4% for initial survey).

Data bases were established on personal computers and the data screened for consistency and completeness. There was some discrepancies noted in the reporting of distributor sales by suppliers, as some respondants were confused by the questions. These results were adjusted to be consistent, taking into consideration the other information provided, such as trends, individual product area sales and employment levels.

Considering the quality and quantity of the responses, SFMRB believes the values currently reported to be plus or minus 10-20% of reality.

Additional information, collected during the current survey, but not included in this report, has been retained and may be made available from the SFMRB upon the request of the AESF, MFSA or NAMF.

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PLANT LOCATIONS

Both of the surveys requested that respondants include a state so that information could be provided as to the location of plant sites. The table below summarizes the percentage of plant sites for captive and job shop finishers and for the suppliers in the ten geographical regions.

Nearly 40% of the responding finishers and close to 50% of the suppliers are located in the combined east and west central regions. The Middle Atlantic area was the next largest for suppliers with about 20%. The Pacific Coast area was second for finishers with 19%. In general, job shops responded with more usable data than did captive shops, who apparently found the questionnaire difficult to complete.

LOCATION OF RESPONDANTS

AREA	FINISHERS	SUPPLIERS
NEW ENGLAND	7.9%	10.1%
MID-ATLANTIC	12.0%	20.3%
SOUTHEAST	8.7%	8.7%
EAST CENTRAL	19.7%	26.1%
WEST CENTRAL	18.9%	23.2%
SOUTHWEST	8.2%	1.5%
MOUNTAIN	1.3%	0.0%
PACIFIC COAST	19.2%	5.8%
CANADA	0.0%	4.3%
NOT REPORTED	4.1%	0.0%

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BUSINESS ORIENTATION

The general and categorical trends, summarized in the numerous tables in this section, are based on responses from 297 job shops, 85 captive shops and 69 material and equipment suppliers.

The breakdown of the 69 suppliers' business orientation is shown below. Most suppliers perform more than one function.

SUPPLIER BUSINESS ORIENTATION

	RESPONSES	RESPONSE %
MATERIAL MANUFACTURER	33	48%
MATERIAL DISTRIBUTOR	29	42%
EQUIPMENT MANUFACTURER	37	54%
EQUIPMENT DISTRIBUTOR	37	54%
TOTAL RESPONSES	69	100%

Many suppliers indicate that they act both as a manufacturer and a distributor of materials and/or equipment. The following is the business orientation when the supplier respondants are viewed from that prospective.

SUPPLIER BUSINESS ORIENTATION

	RESPONSES	RESPONSE %
MATERIALS		
MANUFACTURE ONLY	12	29%
DISTRIBUTE ONLY	10	24%
MANUFACTURE & DISTRIBUTE	19	46%
EQUIPMENT		
MANUFACTURE ONLY	19	37%
DISTRIBUTE ONLY	16	31%
MANUFACTURE & DISTRIBUTE	16	31%

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BUSINESS TRENDS

The past 5-year and future 2-year projection data in this section is reported two ways. Some data are reported only by the number of mentions while other data are sales weighted.

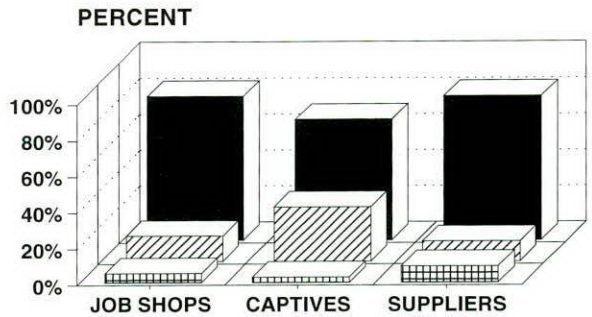
Past Business Trends

A summary of the trends in business volume of the respondants covering the past 5 years is shown below. Four-fifths of the job shops and suppliers experienced an increase over the period. So did two-thirds of the captives. Almost a third of the captives had business reductions.

PAST BUSINESS TRENDS
(NUMBER OF MENTIONS, LAST 5 YEARS)

	JOB SHOPS	CAPTIVE SHOPS	SUPPLIERS
BUSINESS UP	80%	67%	80%
BUSINESS DOWN	14%	30%	11%
UNCHANGED	5%	3%	9%

BUSINESS TRENDS-PAST 5 YEARS
NUMBER OF MENTIONS



	JOB SHOPS	CAPTIVES	SUPPLIERS
UP TREND	80%	67%	80%
DOWN TREND	14%	30%	11%
NO CHANGE	5%	3%	9%

NO CHANGE DOWN TREND UP TREND

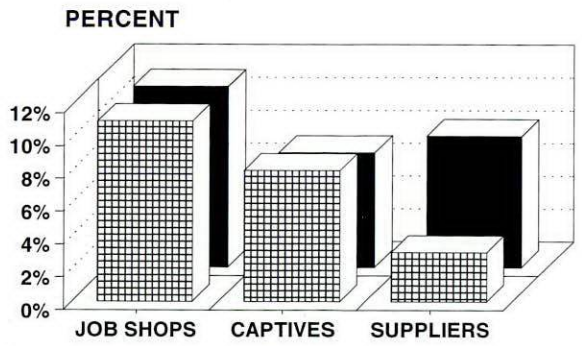
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The job shop finishers who had a growth in business over the past 5 years exceeded a 10% annual rate when the values were sales weighted. The automotive sector was the major contributor. Captive finishers were up 7% with building and construction as the leading sector. Suppliers with increased business experienced approximately the same growth. Finishers that experienced losses reported drops in the 8 to 11% range tied mainly to the aerospace sector. Those suppliers with reduced revenues reported decreases around 3%.

SALES WEIGHTED BUSINESS TRENDS
(ANNUAL RATE OF CHANGE, LAST 5 YEARS)

	JOB SHOPS	CAPTIVE SHOPS	SUPPLIERS
BUSINESS UP	11%	7%	8%
BUSINESS DOWN	11%	8%	3%

BUSINESS TREND--PAST 5 YEARS
SALES WEIGHTED--AVERAGE % CHANGE



	JOB SHOPS	CAPTIVES	SUPPLIERS
UP TREND	11%	7%	8%
DOWN TREND	11%	8%	3%

▦ DOWN TREND ■ UP TREND

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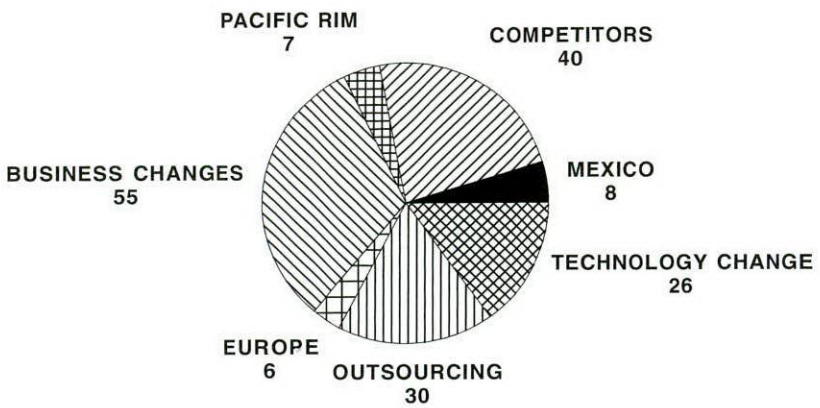
Respondants attribute the general reason for their past 5-year business increase mostly to changes in business conditions. The second most mentioned reason was business taken from U. S and Canadian competitors. Suppliers attribute a good amount of their increase to changes in technology.

INCREASING BUSINESS
(SALES WEIGHTED, LAST 5 YEARS)

	FINISHERS	SUPPLIERS
CHANGE IN BUSINESS CONDITIONS	55%	58%
US/CANADIAN COMPETITORS	40%	44%
OUT-SOURCING BY CAPTIVES	30%	---
TECHNOLOGY CHANGE	26%	46%
EUROPE	6%	13%
MEXICO	8%	21%
PACIFIC RIM	7%	19%

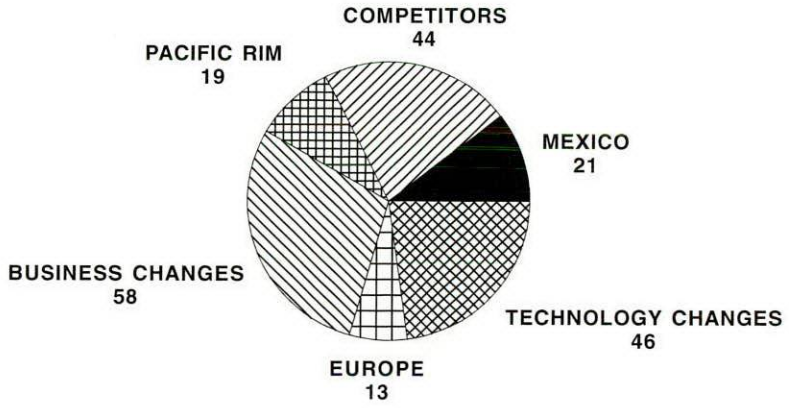
MULTIPLE MENTIONS FROM MOST RESPONDENTS GAVE VALUES IN THIS TABLE EXCEEDING 100%

INCREASING BUSINESS--PAST 5 YEARS
SALES WEIGHTED--FINISHING SHOPS (%)



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INCREASING BUSINESS-PAST 5 YEARS
SALES WEIGHTED--SUPPLIERS (%)



Likewise, reasons for past business decreases were also mainly attributed to changes in business conditions, competitors and technology changes.

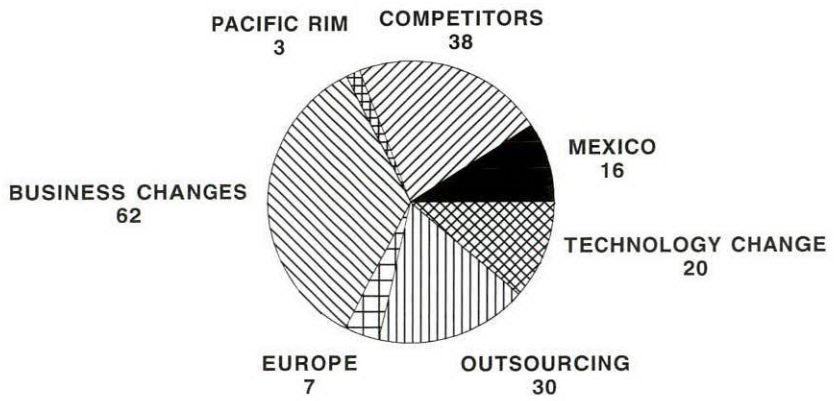
DECREASED BUSINESS
(SALES WEIGHTED, PAST 5 YEARS)

	FINISHERS	SUPPLIERS
CHANGE IN BUSINESS CONDITIONS	62%	50%
US/CANADIAN COMPETITORS	38%	33%
OUT-SOURCING BY CAPTIVES	30%	---
TECHNOLOGY CHANGE	20%	50%
EUROPE	7%	17%
MEXICO	16%	17%
PACIFIC RIM	3%	17%

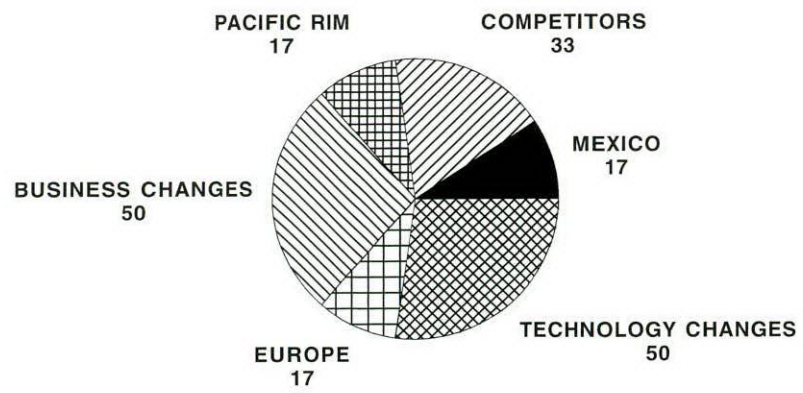
MULTIPLE MENTIONS FROM MOST RESPONDANTS GAVE VALUES IN THIS TABLE EXCEEDING 100%

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DECREASING BUSINESS--PAST 5 YEARS
SALES WEIGHTED--FINISHING SHOPS (%)



DECREASING BUSINESS-PAST 5 YEARS
SALES WEIGHTED--SUPPLIERS (%)



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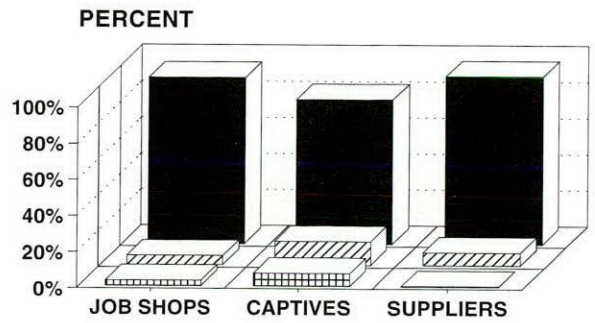
Future Trends

Four-fifths or more of all respondants forecasted an upturn in business and only 13% or less expected a downturn over the next 2 years. The balance forecasted little or no change as shown below:

FUTURE BUSINESS TRENDS
(NUMBER OF MENTIONS, NEXT 2 YEARS)

	JOB SHOPS	CAPTIVE SHOPS	SUPPLIERS
BUSINESS UP	92%	80%	93%
BUSINESS DOWN	5%	13%	7%
UNCHANGED	3%	7%	0%

BUSINESS TRENDS-NEXT 2 YEARS
NUMBER OF MENTIONS



	JOB SHOPS	CAPTIVES	SUPPLIERS
UP TREND	92%	80%	93%
DOWN TREND	5%	13%	7%
NO CHANGE	3%	7%	0%

NO CHANGE DOWN TREND UP TREND

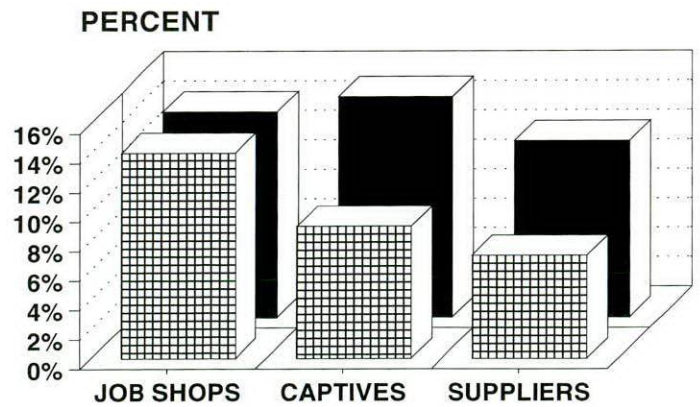
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Finishers forecasting an increase in the next 2-years' business, averaged (sales weighted) 14-15% upwards annually. Suppliers were slightly less optimistic. Job shops forecasting decreases average 14% downward annually. The supplier and captive forecasted decreases were less sharp at 7-9% downward annually.

SALES WEIGHTED BUSINESS TRENDS
(ANNUAL RATE OF CHANGE, NEXT 2 YEARS)

	JOB SHOPS	CAPTIVE SHOPS	SUPPLIERS
BUSINESS UP	14%	15%	12%
BUSINESS DOWN	14%	9%	7%

BUSINESS TREND--NEXT 2 YEARS
SALES WEIGHTED--AVERAGE % CHANGE



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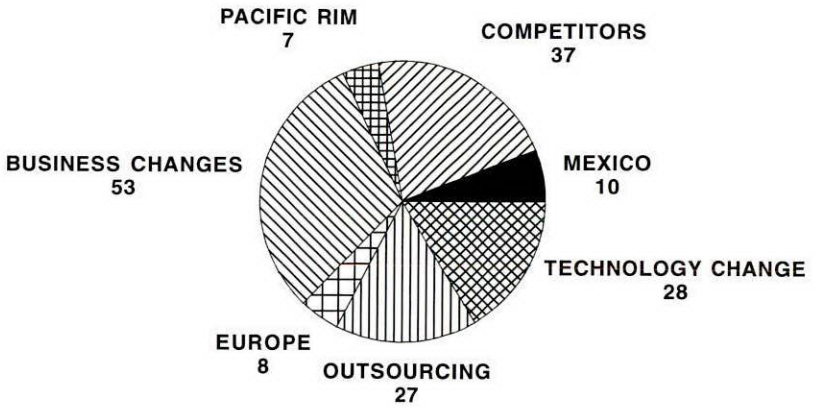
Finishing shops most frequently anticipate their near term business growth to come by taking business from their U.S. and Canadian competitors and the continued general upswing of the economy. The automotive and construction sectors were most prominently mentioned. Out-sourcing by captive finishers and technology changes also received significant mention. Mexico as a reason for business growth seems to have decreased. Suppliers most often mentioned improving economic conditions and technology changes as reasons for optimism. Also U.S./Canadian competition had significant mentions.

INCREASING BUSINESS
(SALES WEIGHTED, NEXT 2 YEARS)

	FINISHERS	SUPPLIERS
CHANGE IN BUSINESS CONDITIONS	53%	62%
US/CANADIAN COMPETITORS	37%	46%
OUT-SOURCING BY CAPTIVES	27%	---
TECHNOLOGY CHANGE	28%	61%
EUROPE	8%	20%
MEXICO	10%	34%
PACIFIC RIM	7%	25%

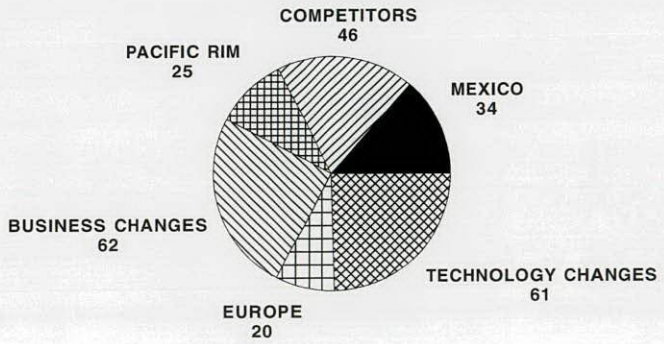
MULTIPLE RESPONSES FROM MOST RESPONDANTS GAVE VALUES IN THIS TABLE EXCEEDING 100%

INCREASING BUSINESS--NEXT 2 YEARS
SALES WEIGHTED--FINISHING SHOPS (%)



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INCREASING BUSINESS-NEXT 2 YEARS
SALES WEIGHTED--SUPPLIERS (%)



Decreased finisher business forecasts seemed predominantly driven by expected changes in business conditions due to sector shrinkage. The defense and consumer durables sectors were mentioned most often. Neither Mexico, the Pacific Rim, nor Europe were seen as significant factors. For equipment suppliers, the most commonly mentioned area for future downturn was, as with finishers, shrinkage of end use sectors. North American competition was also mentioned by the few suppliers.

DECREASED BUSINESS
(SALES WEIGHTED, NEXT 2 YEARS)

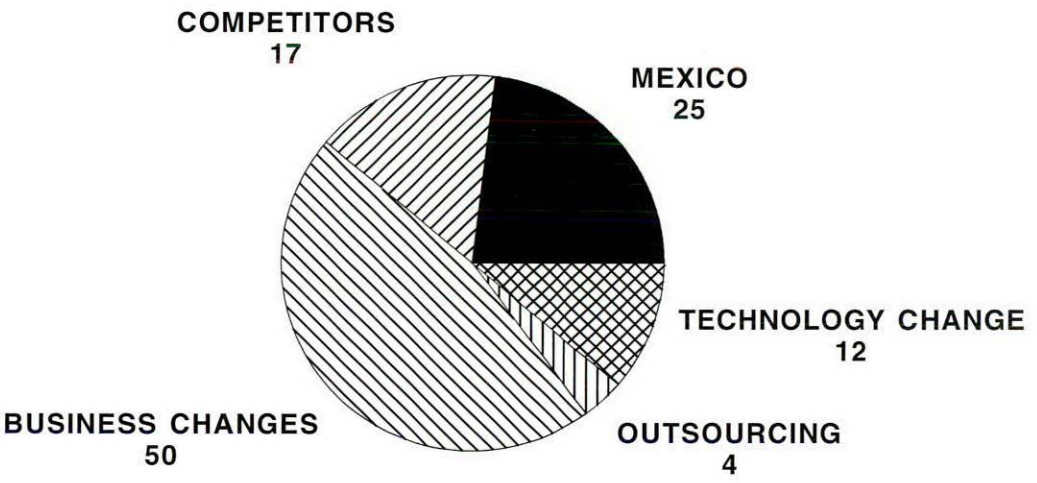
	FINISHERS	SUPPLIERS
CHANGE IN BUSINESS CONDITIONS	50%	50%
US/CANADIAN COMPETITORS	17%	25%
OUT-SOURCING BY CAPTIVES	4%	---
TECHNOLOGY CHANGE	12%	0%
EUROPE	0%	0%
MEXICO	25%	0%
PACIFIC RIM	0%	0%

MULTIPLE MENTIONS FROM MANY RESPONDANTS GAVE VALUES IN THIS TABLE EXCEEDING 100%

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DECREASING BUSINESS--NEXT 2 YEARS

SALES WEIGHTED--FINISHING SHOPS (%)



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JOB AND CAPTIVE FINISHERS

Employment and Sales

Responses for employment were received from 293 job shop and 80 captive finishers. The job shop response was significantly higher than in the initial survey. The employee statistics summarized below cover only those facilities that provided both employee and total sales data. A slight reduction is indicated in the average job shop sales per employee (11%) compared to the initial survey. The average number of captive employees and sales per employee values were determined for the first time. Sales per employee values were 2.7 times higher than for job shops, while the average number of employees per facility was the same. The captive sales values were determined from a limited (32) useful-response data base, an area which could be a focus for the next study. An average of 12% of job shop employees are reported to be part time.

FINISHER EMPLOYEE STATISTICS

TYPE	# OF SHOPS	# OF EMPLOYEES	AVERAGE EMPLOYEES	AVG. SALES/ EMPLOYEE
CURRENT SURVEY				
JOB SHOP	293	9,756	33	$80,000
CAPTIVE	80	2,621	33	$215,000
INITIAL SURVEY				
JOB SHOP	117	4,280	37	$89,000
CAPTIVE	54	3,717	--	-------

THE MEDIAN NUMBER OF EMPLOYEES IS 21 FOR JOB SHOPS AND 12 FOR CAPTIVES IN THE CURRENT SURVEY

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The average number of employees per facility was same for job and captive facilities. Sales volumes for job shop facilities are summarized below. The average sales per facility, average employees per facility and average sales per employee ratios are used in later scale-up estimates of the total size of the metal finishing market.

SALES STATISTICS FOR JOB SHOPS

TOTAL SALES REPORTED	$ 643,089,000
AVERAGE SALES	$ 2,660,000
MEDIAN SALES	$ 1,400,000

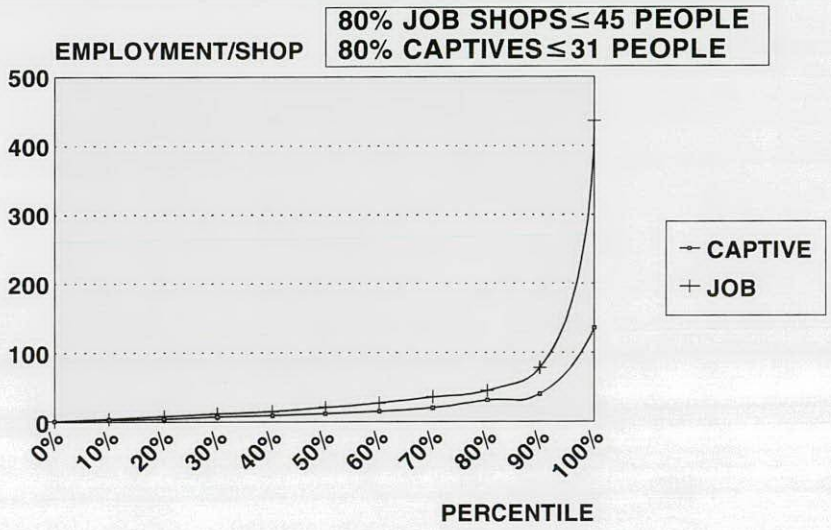
Facilities were analyzed by distribution of number of employees for both job and captive finishers. Also job shop sales and facility sizes were compared. The average job shop facility reported has 25,129 square feet. The table describes in more detail the distribution in factory sizes.

SIZE OF FINISHING SHOPS

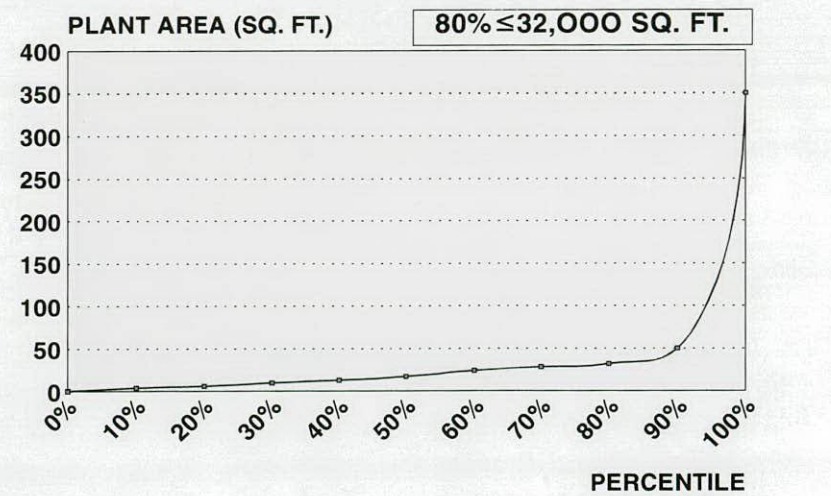
PERCENTILE	CAPTIVE SHOP EMPLOYEES	JOB SHOP EMPLOYEES	JOB SHOP SQ. FT. (000)	JOB SHOP SALES ($000)
1st POINT	1	1	0.1	100
1-10	3	4	4	300
11-20	4	8	6	500
21-30	7	12	10	800
31-40	9	15	13	1000
41-50	12	21	17	1400
51-60	15	27	24	2000
61-70	20	36	28	2500
71-80	31	45	32	3400
81-90	40	78	50	5200
91-100	136	436	350	40000

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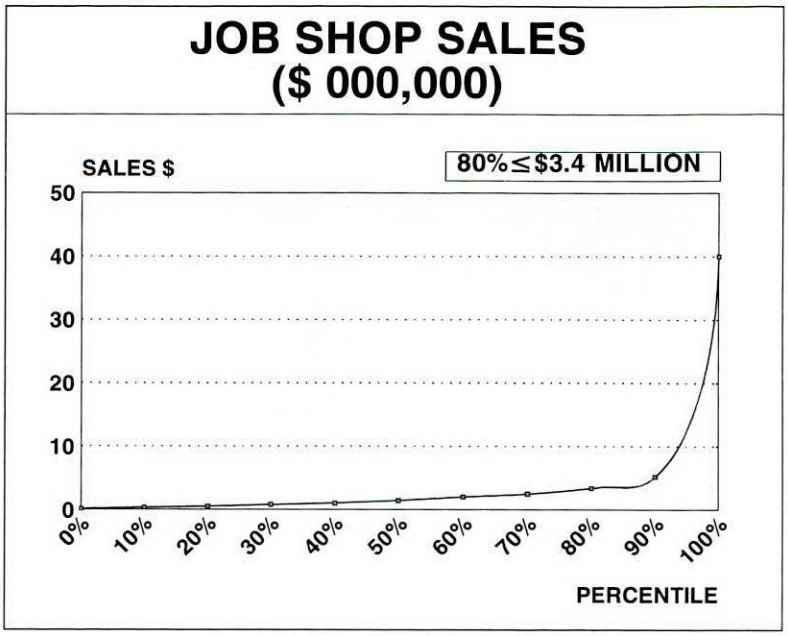
EMPLOYMENT DISTRIBUTION JOB AND CAPTIVE FINISHING SHOPS



SQUARE FOOTAGE OF JOB SHOPS (000)



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Job Shop Costs

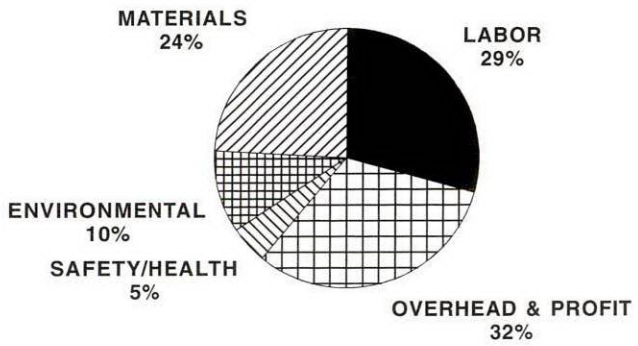
Based on both the average response and the sales-weighted average response, 222 job shops reported typical direct labor costs of 29-32%, direct material costs of 19-24%, environmental costs of about 9-10% and OSHA/Safety costs of 4-5%. All categories were higher than reported from the last survey. This variation would indicate an area needed for future SFMRB study. SFMRB speculates that for many shops the 15% total compliance area cost is more than their pre-tax profits.

JOB SHOP COSTS
(% OF SALES)

	LABOR	MATERIAL	ENVIRON-MENTAL	SAFETY & HEALTH
CURRENT SURVEY				
AVERAGE %	32.6%	19.3%	9.0%	4.3%
SALES WEIGHTED %	29.1%	24.2%	10.1%	4.8%
INITIAL SURVEY				
SALES WEIGHTED %	28.0%	14.4%	5.1%	2.5%

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JOB SHOP COST ELEMENTS (%) (SALES WEIGHED BASIS)



24

Markets Served

The present geographic markets served by finishers are summarized below. The total for finishers is proportional to the number of responses. The captive and job shop percentages are weighted by sales levels. As expected, the domestic U.S. market dominates.

GEOGRAPHIC MARKET FOR FINISHERS

	USA	CANADA	MEXICO	OTHER
ALL FINISHERS	96.9%	1.5%	0.6%	1.0%
JOB SHOPS	96.5%	1.7%	0.8%	1.0%
CAPTIVES	90.0%	2.6%	1.6%	5.8%

ALL FINISHERS DATA BASED ON THE NUMBER OF MENTIONS
JOB AND CAPTIVE SHOPS BASED ON SALES WEIGHTED RESPONSES

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The two dominant domestic markets are automotive and consumer durables followed by civilian aerospace, defense and recreational goods. The following table provides a complete breakdown of the market segments served by finishers. The blanks in this table represent changes in the survey forms, not zero activity in these segments.

FINISHER END USE MARKET SEGMENTS

SEGMENT	INITIAL SURVEY-1993	CURRENT SURVEY-1993	CURRENT SURVEY-1994
AUTOMOTIVE	47.9%	38.4%	35.1%
CONSUMER DURABLES	13.4%	17.0%	19.2%
CONSTRUCTION	---	6.4%	8.1%
GOV'T & AEROSPACE	9.0%	---	---
DEFENSE/GOV'T	---	8.1%	10.8%
CIVILIAN AEROSPACE	---	10.3%	9.6%
MACHINE TOOLS & HYDRAULICS	5.4%	3.9%	3.8%
JOB SHOP	7.8%	1.8%	1.5%
ELECTRONICS & COMPUTERS	11.1%	5.4%	4.8%
OTHER	5.4%	8.7%	7.1%
	100%	100%	100%

Substrates

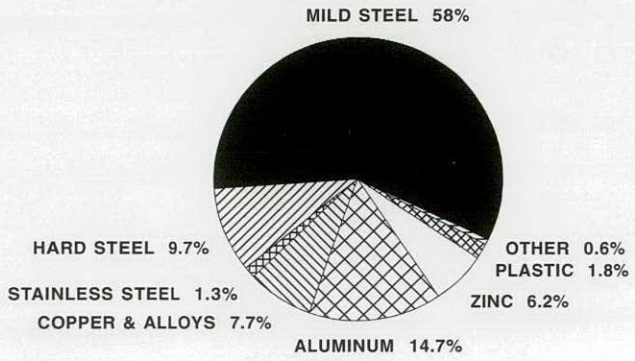
A total of 324 facilities reported 1994 data with an annual average of 1,900,000 square feet plated per line. Metal finishing is mainly a steel substrate business and accounts for about 70% of the surface area finished. The changes in the percentage of aluminum, copper & copper alloys, and plastics are likely a function of an in sufficient number of respondants rather than a real change in one year. As was anticipated in the initial survey, the zinc substrate value was too low. The latest survey corrected that issue. This is an area for continued work by the SFMRB.

METAL FINISHING SUBSTRATES
(BASED ON SURFACE AREA)

	INITIAL SURVEY	CURRENT SURVEY
MILD STEEL	59.0%	58.0%
HARD STEEL	9.2%	9.7%
STAINLESS STEEL	0.8%	1.3%
COPPER & COPPER ALLOYS	14.2%	7.7%
ALUMINUM	7.4%	14.7%
ZINC	1.6%	6.2%
PLASTIC	6.4%	1.8%
OTHER	1.4%	0.6%
	100.0%	100.0%

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SUBTRATES FINISHED



Metal Finishing Equipment

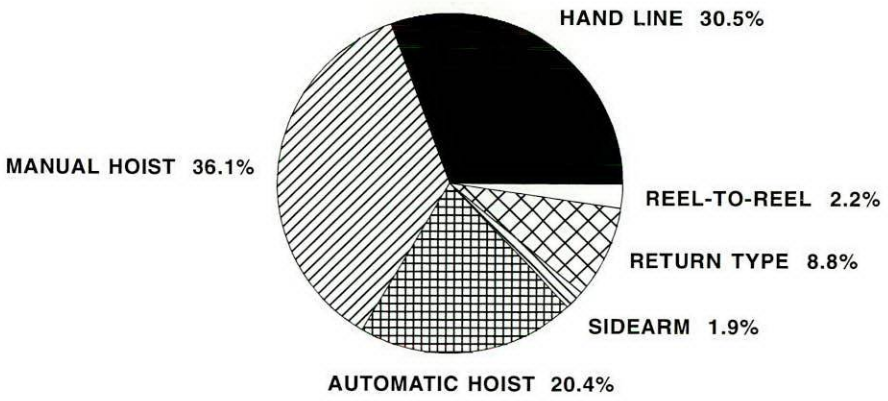
A total of 380 facilities reported data with an average of 2.3 plating lines per shop. The most common types of equipment were manually operated hoists, hand lines and automatic hoists respectively. These three types of equipment account for nearly 90% of the installed capacity in the current report. Although it may be related to the higher percentage reporting by job shops, equipment to run barrels accounts for 22% of all lines. Rack lines account for 55% and the balance are either dual purpose (rack & barrel) or reel-to-reel. Due to the large variance in barrel vs rack equipment used between the current and the initial survey, this will be an area for continued study.

EXTENT OF AUTOMATION IN METAL FINISHING SHOPS

EQUIPMENT TYPE	INITIAL SURVEY	CURRENT SURVEY
HANDLINE	25.7%	30.5%
MANUAL HOIST	40.7%	36.2%
AUTOMATIC HOIST	16.7%	20.4%
SIDEARM	4.1%	1.9%
RETURN TYPE	8.7%	8.8%
REEL-TO-REEL	4.1%	2.2%

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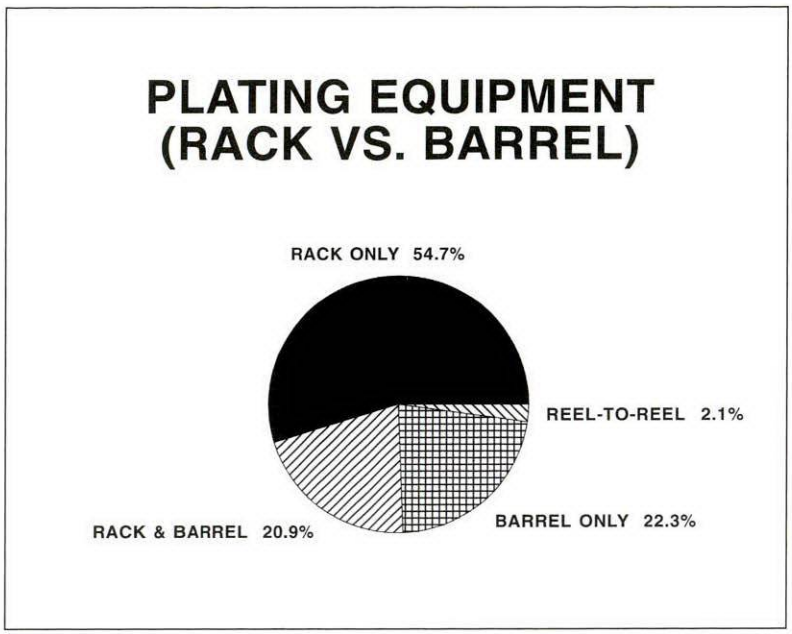
PLATING EQUIPMENT



EXTENT OF AUTOMATION IN METAL FINISHING SHOPS

EQUIPMENT TYPE	INITIAL SURVEY	CURRENT SURVEY
RACK ONLY	30.9%	54.7%
RACK & BARREL	27.6%	20.9%
BARREL ONLY	37.4%	22.3%
REEL-TO-REEL	4.1%	2.1%

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Materials Usage by Finishers

Since the postcard survey data was insufficient for use, the economic data generated from the initial survey had to be used. It is reproduced here. The most frequently reported materials are shown below. They are listed by the descending number of shops indicating use of the material. Zinc and related materials, bright nickel, cyanide copper, and chromium plating predominate. Electroless nickel was reported by 17 users while the next most commonly used reported material was only mentioned by 12 users. Values for the annual consumption per tank and consumption per tank gallon are shown. There is no definition for miscellaneous surface preparations as this was the catch-all category for things that were not soak cleaners, strippers, electrocleaners, etc. The SFMRB is concerned about the accuracy (high value) of the electrolytic nickel anode data, but no obvious error in the questionnaires was found.

MATERIALS USAGE BY FINISHERS
(FROM INITIAL SURVEY)

MATERIALS	$ SPENT ($000)	COUNT	AVG. $ PER TANK ($000)	AVG. $ PER TANK-GALLON
PURE Zn ANODES	$730.9	46	$15.9	$6.62
HEX-Cr	$141.1	40	$3.5	$4.42
BRIGHT Ni	$801.5	39	$20.6	$9.75
ACID Zn	$802.1	26	$30.8	$9.92
CHROMIC ACID	$139.9	26	$5.4	$3.52
CATALYST IN CHROMIC ACID	$156.2	24	$6.5	$4.77
CYANIDE Cu	$77.4	23	$3.4	$3.08
ELECTROLYTIC Ni ANODES	$2505.0	22	$113.9	$32.34
MISC. SURFACE PREPS.	$2176.5	22	$98.9	$43.51
SODIUM CYANIDE	4100.7	20	$5.0	$2.93
TRIVALENT CHROMATES	$56.8	20	$2.8	$7.37
ELECTROLESS Ni	$616.3	17	$36.3	$88.29

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In the most recent questionnaire we received considerable information on the frequency and square footage being processed (pounds for zinc plating). There were a total of 374 sites reporting a total of 892 plating lines. Within these lines there were 5257 processes (unit operations) indicated. These 5257 unit operations were weighted by the square footage (poundage for zinc and chromates) being processed and ranked in descending order on the following two charts. One can think of this as the probability of what unit operation any arbitrary square foot (pound) of substrate area is in at any given time. For example, 16.7% of the substrate being processed is in a soak cleaner at any time. If you divided the number of unit operation by the number of lines (892) you have the probability of any random line containing that unit operation. For example, soak cleaners are used in 66% of plating lines (588/892).

PROCESSES USED BY FINISHERS
(WEGHTED BY SQUARE FOOTAGE OR POUNDAGE)

PROCESS	# OF UNIT OPERATIONS	PERCENT	SQUARE FEET OR POUNDAGE
SOAK CLEANERS	588	11.2%	16.2% SQ. FT.
ELECTROCLEANERS	482	9.2%	14.1% SQ. FT.
ACID ACTIVATORS	456	8.7%	9.1% SQ. FT.
PREPAINT CLEANERS	339	6.5%	7.9% SQ. FT.
HEXAVALENT CHROMIUM	240	4.6%	6.6% SQ. FT.
FUME SUPPRESANTS	135	2.6%	4.9% SQ. FT.
PREPAINT CHROME SEALANTS	119	2.3%	4.5% SQ. FT.
POLISHES & BRIGHT DIPS	199	3.8%	3.5% SQ. FT.
BRIGHT NICKELS	205	3.9%	3.2% SQ. FT.
PARTS STRIPPERS	213	4.1%	2.8% SQ. FT.
ELECTROLYTIC NICKELS	178	3.4%	2.6% SQ. FT.
RACK STRIPPERS	152	2.9%	2.6% SQ. FT.
PREPAINT IRON PHOSPHATE	56	1.1%	2.3% SQ. FT.
OTHER PLATING PROCESSES	57	1.1%	2.1% SQ. FT.
CYANIDE COPPERS	155	3.0%	1.8% SQ. FT.
SEMIBRIGHT NICKELS	80	1.5%	1.8% SQ. FT.
PREPAINT OTHER SEALANTS	87	1.7%	1.6% SQ. FT.
PURE TIN	92	1.8%	1.6% SQ. FT.
PREPAINT ZINC PHOSPHATE	46	0.9%	1.5% SQ. FT.
ACID COPPERS (NOT PCB)	103	2.0%	1.4% SQ. FT.
TIN ALLOY AND SOLDER	47	0.9%	1.3% SQ. FT.
OTHER CLEANERS & STRIPPERS	27	0.5%	1.2% SQ. FT.
ELECTROLESS NICKELS	118	2.2%	1.1% SQ. FT.

PROCESSES USED BY FINISHERS
(WEGHTED BY SQUARE FOOTAGE OR POUNDAGE)

PROCESS	# OF UNIT OPERATIONS	PERCENT	SQUARE FEET OR POUNDAGE
BRASS & BRONZE	62	1.2%	0.8% SQ. FT.
TRIVALENT CHROMIUM	40	0.8%	0.7% SQ. FT.
OTHER NICKELS	89	1.7%	0.6% SQ. FT.
TUMBLING COMPOUNDS	60	1.1%	0.5% SQ. FT.
CADMIUM	50	1.0%	0.4% SQ. FT.
PCB PREPLATE CHEMICALS	14	0.3%	0.3% SQ. FT.
PREPAINT OTHER PHOSPHATE	33	0.6%	0.2% SQ. FT.
PCB-OTHER PROCESSES	7	0.1%	0.2% SQ. FT.
PCB SOLDER STRIPPERS	6	0.1%	0.1% SQ. FT.
PCB DIRECT PLATING	9	0.2%	0.1% SQ. FT.
PCB ACID COPPER	12	0.2%	0.1% SQ. FT.
PCB ELECTROLESS COPPER	3	0.1%	0.1% SQ. FT.
ELECTROLESS COPPER (NOT PCB)	11	0.2%	0.1% SQ. FT.
OTHER COPPERS	18	0.3%	0.1% SQ. FT.
ANTIQUING/DARKENING CMPDS.	51	1.0%	0.1% SQ. FT.
HEXAVALENT CHROMATES	227	4.3%	32.4% POUNDAGE
ACID ZINCS	119	2.3%	32.3% POUNDAGE
TRIVALENT CHROMATES	120	2.3%	21.7% POUNDAGE
ALKALINE, NON-CYANIDE ZINCS	93	1.8%	10.8% POUNDAGE
ZINC ALLOY PROCESSES	22	0.4%	2.0% POUNDAGE
CYANIDE ZINCS	36	0.7%	0.8% POUNDAGE

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MATERIAL SUPPLIERS

Proprietary Chemicals

In order to avoid any risk of competitive information being publicly divulged in this study, only those materials with eight or more suppliers reporting are shown below. The most frequently sold products tend to be cleaners, electroless nickel, zinc plating materials and their related chromates, bright nickel, and various phosphates. In terms of 1994 sales value, the cleaners, electroless nickels and bright nickels have the largest values shown in the following two tables. SFMRB believes that about two-thirds of the large and middle sized suppliers reported their data.

SALES BY MATERIAL SUPPLIERS

MATERIAL	$000 1992 SALES [1]	$000 1993 SALES [1]	$000 1994 SALES [1]	1992 COUNT	1993 COUNT	1994 COUNT
SOAK CLEANERS	$8,955	$9,048	$9,916	18	12	13
ELECTROLESS Ni	$37,918	$4,449	$5,661	17	11	11
ELECTROCLEANERS	$8,764	$3,029	$3,580	17	9	10
ALK. NON-CYANIDE Zn	$4,677	$1,772	$2,195	16	9	9
ACID Zn	$8,183	$4,407	$5,120	16	10	11
BRIGHT Ni	$13,213	---	$4,995	15	--	11
HEXAVALENT CHROMATES	$7,565	---	$3,301	14	--	8
CYANIDE Zn	$1,609	$860	$981	14	8	9
CYANIDA Cu	$1,509	---	---	14	--	--
ACID ACTIVATORS	$3,033	$1,314	$1,427	14	8	9
PARTS STIPPERS	$4,629	---	$867	13	--	8
GENERAL USE ACID Cu	$7,594	---	---	12	--	--
MISC. PWB PROCESSES	$8,863	---	---	10	--	--
PREPAINT IRON PHOSPHATE	---	$9,766	$10,286	--	8	10

[1] SALES AND COUNTS ARE AS REPORTED FROM THE SURVEYS

SALES BY MATERIAL SUPPLIERS

MATERIAL	$000 1992 SALES [1]	$000 1993 SALES [1]	$000 1994 SALES [1]	1992 COUNT	1993 COUNT	1994 COUNT
PURE Zn ANODES	$3,076	1.12 [2]	0.99 [2]	9	9	9
PWB PREPLATE [3]	$7,801	---	---	9	--	--
PURE Sn	$3,205	---	$734	9	--	8
ZINCATES FOR Al	$2,396	---	---	9	--	--
TRIVALENT CHROMATES	$784	---	---	9	--	--
POLISHES & BRIGHT DIPS	$1,394	---	$10,098	9	--	8
PURE Sn ANODES	$741	---	---	8	--	--
OFHC Cu ANODES	$970	---	---	8	--	--
DEPOLARIZED Ni ANODES	$33,397	---	---	8	--	--
CATALYST IN CHROMIC ACID	$9,475	---	---	8	--	--
SEMIBRIGHT Ni	$2,953	---	---	8	--	--
PREPAINT CLEANERS	---	---	$23,914	--	--	9
PREPAINT Zn PHOSPHATE	---	---	$2,828	--	--	8
CHROMIC ACID	---	4.32 [2]	4.93 [2]	--	8	8

[1] SALES AND COUNTS AS REPORTED FROM THE SUREVEYS
[2] MILLIONS OF POUNDS
[3] EXCLUDING ETCHANTS

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Employees and Sales

Based on useful responses from 18 material suppliers, the average annual sales revenues were calculated as $302-368,000/employee in 1993 and 1994 respectively. This relatively high value, compared to our last report ($180,000), is related to the fact that we have now accounted for the material suppliers' distributors.

SFMRB estimates that distributors account for about 20% of the sales of proprietary products to end user customers. Furthermore, SFMRB estimates that approximately 80-90% of the products where sales were reported in pounds, such as anodes and nickel salts, are sold through distributors.

Since a very small response was received from pure distributors (those who do not manufacture), a specific analysis on distributors was not undertaken. The limited distributor data indicates, however, on average very few employees (2 to 3) and a high sales per employee value ($1,000,000). Based on a survey of the directories and input from the distributor committee of MFSA it is estimated that there are 200 pure equipment and/or material distributors in North America who serve the metal finishing industry. Assuming 3 employees per distributor, 200 distributors and $1,000,000 in sales per employee, an annual pure distributor metal finishing sales value of $600 million is indicated.

MATERIAL SUPPLIER STATISTICS

	SALES ($000)	AVG. # OF EMPLOYEES	AVG. SALES/ SUPPLIER ($000)	AVG. SALES/ EMPLOYEE ($000)
1993	$228,000	42	$12,700	$302,000
1994	$256,000	41	$15,100	$368,000

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Based on an independent study of the key industry supplier directories, it was estimated that there are about 180 material manufacturer/supplier companies, many of whom also act a distributors, to serve the consumable materials needs of the metal finishers. Using the sales per employee ratios calculated earlier, SFMRB estimates an annual metal finishing material supplier business of approximately $2.7 billion for 1994.

SIZE OF MATERIAL SUPPLIER BUSINESS

	AVG. SALES/ EMPLOYEE	NUMBER OF SUPPLIERS	TOTAL # OF EMPLOYEES	TOT. SALES $MILLION
1993	$302,000	180	7560	$2,283
1994	$368,000	180	7380	$2,716

Metal Salts

Only very limited information was received from manufacturers or importers of chemical salts such as nickel sulfate, copper sulfate, chromic acid, etc. For many of these materials, there are only two to four suppliers. Most of them expressed concern that contributing this information to SFMRB would weaken their competitive position. This will be an issue to resolve in future years, but for now, no meaningful metal salt statistics can be reported.

Anodes

Although there was privileged information provided on the total nickel anode market by one of the major suppliers, there was not enough data developed to define the copper, zinc, tin, cadmium, and other anode volumes. Improving this information will continue to be a key objective for SFMRB.

Surface Preparation

Data was not available from a large enough fraction of the cleaner and surface preparation suppliers to enable any scaling of shop usage to total demand. A simple, historic estimate of cleaners and strippers as 30% of total proprietary chemical sales is the best the SFMRB can suggest at this time. Enhancing the information on cleaners and surface preparation material will be a focus next year, assuming the issue on anodes can be resolved.

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EQUIPMENT SUPPLIERS

System Sales

Twenty-four equipment suppliers reported the following sales of manual plating, automatic processing and environmental (wastewater treatment and air handling) systems.

EQUIPMENT SYSTEM SALES

	MANUAL ($000)	AUTOMATIC ($000)	ENVIRONMENTAL ($000)
1993	$7,299	$8,433	$9,505
1994	$8,947	$11,238	$11,714

INCLUDES MANUFACTURERS WHO ALSO DISTRIBUTE OR ACT AS OEM'S

Component Sales

Twenty-four supplier companies reported the following sales of process, wastewater treatment and air handling components.

EQUIPMENT SALES

	PROCESS ($000)	WASTEWATER ($000)	AIR ($000)
1993	$7,440	$92	$871
1994	$8,210	$125	$1,037

INCLUDES MANUFACTURERS WHO ALSO ACT AS DISTRIBUTORS

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Employment and Sales

Based on the data provided, metal finishing equipment suppliers had an average of 17-21 employees for the years 1993 and 1994, $6.7-7.4 million in annual sales, and $350-400,000 in sales per employee. These averages are higher than the initial report, since less labor intensive distribution and OEM system functions, common with equipment suppliers, are now accounted.

EQUIPMENT SUPPLIER STATISTICS

	EMPLOYEES	AVG. # OF EMPLOYEES	AVG. SALES/ FIRM ($000)	AVG. SALES/ EMPLOYEE
1993	297	17	$6,765	$398,000
1994	350	21	$7,424	$354,000

1. INCLUDES MANUFACTURERS WHO ALSO SUPPLY OEM SYSTEMS AND/OR ACT AS DISTRIBUTORS
2. ONLY FINISHING RELATED EMPLOYEES ARE COUNTED

From the above ratios (average number of employees and sales per employee) along with an estimate that there are 100 major equipment suppliers (based on an independent review of industry supplier directories) the metal finishing related equipment business is estimated to employ 1700-2100 people with sales of approximately $700 million annually. This translates into $85,500 in annual equipment purchases per finisher or about 3.5% of the average annual job shop sales revenue.

SIZE OF METAL FINISHING EQUIPMENT BUSINESS

	AVG. # OF EMPLOYEES	AVG. SALES/ EMPLOYEE	ESTIMATED # MAJOR FIRMS	TOTAL EMPLOYEES
1993	17	$398,000	100	1700
1994	21	$354,000	100	2100

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OVERALL SUPPLIER DATA

Ownership

Sixty-seven suppliers currently report that nearly 90% are wholly U. S. or Canadian owned. The others have non-U.S./Canadian ownership. The reported ownership data is summarized below.

OWNERSHIP OF SUPPLIERS

	USA	CANADA	OTHER	TOTAL RESPONSES
# RESPONSES	60	2	7	69
PERCENTAGE	87%	3%	10%	100%

Markets Served

Sixty-seven suppliers report that 87% of their metal finishing sales are to the U. S geographic market. The other markets served are shown below.

SUPPLIERS GEOGRAPHIC MARKETS

	USA	CANADA	MEXICO	OTHER	TOTAL
# RESPONSES	58	4	1	3	67
PERCENTAGE	87%	6%	2%	5%	100%

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OVERALL METAL FINISHING BUSINESS

Factory Size

The average supplier facility size from the current survey is reported below. The data confirms the sizes in the initial survey. However, the job shop average of approximately 25,000 square feet in the current report is significantly lower than the 35,000 square feet average initially reported. SFMRB believes that current data is more accurate due to the broader participation by smaller job shops in the current survey.

FACTORY SIZES
(AVERAGE SQUARE FEET)

SUPPLIERS	37,410
JOB SHOPS	25,129

The Metal Finishing Universe

The estimate of the total number of the U. S. and Canadian metal finishers came from the merged mailing list provided to the SFMRB. The list was reviewed for duplicates, duds, etc. in a one-time perusal including removal of obvious consultants, associations, government agencies, etc. To save on postage there were no returns required on questionnaires sent where no metal finishing activity was taking place. These numbers should include painters, coil coaters, anodizers, polishers, vacuum coaters, etc. Although there is considerable sentiment among the SFMRB that this universe is too large, there is no objective basis on which to scale back further.

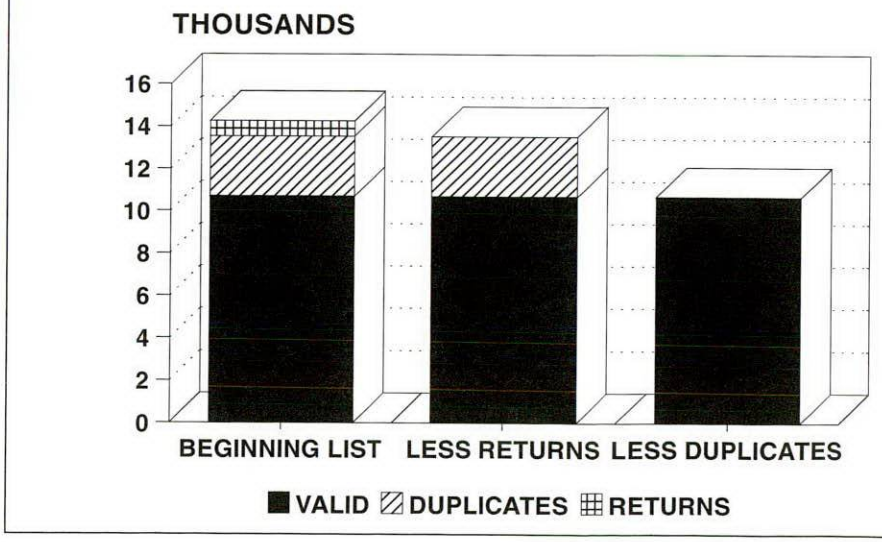
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In view of the significant number of home addresses and a quantity of ancillary activities noted, such as test laboratories, libraries, sales agents, etc., a reduction of 20% was applied to this figure.

UNIVERSE OF METAL FINISHERS

MERGED MAILING LIST	14,258
LESS RETURNS ALLOWANCE (5%)	(713)
LIST LESS RETURNS	13,545
LESS DUPLICATES, NON-QUALIFIERS, ETC. (20%)	(2,852)
ESTIMATED NUMBER OF FINISHERS	10,693

FINISHERS MAILING LIST ADJUSTMENTS



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Data Available

In the initial SFMRB report the method planned to estimate the number of finishing/plating shops involved the use of estimated universes for three items for several widely used processes. The three items were proprietary chemicals, consumable anodes and metal salts. The anodes and metal salts statistics were not provided in sufficient depth to be reliable guides. However a modest amount of process economic data was available on consumption of three proprietary process chemicals per tank. The three proprietary process chemicals were electrolytic nickel, electroless nickel and total zinc (cyanide, alkaline non-cyanide and acid combined). Taking the statistics on total sales from the vendors and inflating them for missing vendors (about 1/3 of the large and medium sized vendors did not respond on electrolytic nickel and zinc) enabled a reasonable estimate to be made. Also available was information on the number of tanks/line, lines/shop, and fraction of shops with any particular process.

It was one of the goals of this current SFMRB survey to improve the quality of process economic information. To that end, the post card survey of shops was initiated. Since only about 25-35 responses were needed for each process, it was hoped that an improved statistic would result from distributing about 81,000 of these post cards in all the industry's trade magazines. With total responses of only 11 valid post cards, no improvement could be made on the initial report's statistics.

Moreover, the response rate from materials suppliers fell off in the current SFMRB survey. To offset that problem, a hasty phone survey of "expert' or "market leaders" was organized in the same three process areas as used for the initial report. After eliminating one outlying statistic, the results provided were:

EXPERTS MARKET ESTIMATE
($ MILLIONS)

PROCESS	# OF EXPERTS	MARKET MAXIMUM	MARKET MINIMUM	AVG. MARKET
ZINC (ALL 3 TYPES)	6	$38	$20	$29
ELECTROLESS Ni	4	$54	$43	$48
ELECTROLYTIC Ni	3	$29	$17	$22

Clearly there is considerable room for improvement in both the gathering of process usage statistics from the metal finishing shops and from the materials suppliers on their sales. This is already an area of active discussion within the SFMRB.

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Number of Plating Shops

The total number of U.S./Canadian metal finishing shops is likely to be close to 7000 as calculated from three independent process bases. These estimates were calculated on the same basis as in the initial report (indicated in the section above) with two adjustments. The first adjustment was to bring the average sale per metal finishing shop up by 7%, which represents the 1994 sales weighted growth/shrinkage of business reported earlier in this report. The second adjustment was to use the "expert" estimates of the total market size for the proprietary chemicals. Using these adjustments:

PLATING SHOP ESTIMATE

PROCESS BASIS	ESTIMATED # SHOPS
ZINC (ALL 3 TYPES)	6803
ELECTROLESS Ni	7338
ELECTROLYTIC Ni	6732
BEST ESTIMATE	7000

A mathematical estimate of these three values would be 6957, hence a rounded value of 7000 is certainly appropriate given the ±10-20% accuracy indicated earlier for this report.

IPC

Courtesy of SFMRB's mentoring organization, the IPC's T/MRC, we have the following 1994 estimated statistics related to bare board production in the U.S. and Canada. The sales values include laminate, drilling, photo-imaging, etc. as well as plating. Developing, in conjunction with IPC, a factor to apply to this total that represents wet processing will be a future activity for the SFMRB.

PCB MARKET STATISTICS
(COURTESY OF THE IPC T/MRC)

CATEGORY	# OF SHOPS	SALES ($ 000,000)
INDEPENDENTS	800	$4,386
CAPTIVES	20	$1,075
TOTAL	820	$5,461

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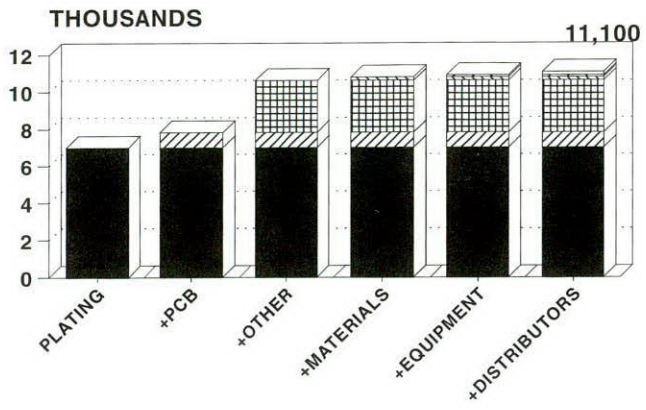
Size of Metal Finishing Business

We can now summarize what we know about the metal finishing industry in North America. It involves more than 11,000 companies with nearly 400,000 employees. This assumes 33 employees per finisher. Both job and captive shops have virtually the same number of employees per shop and the SFMRB estimates that the total number of shops is divided 50/50 between job shops and captives. The total sales of material and equipment to the industry is about $56 billion (US). In terms of GDP contribution, the sales to the finishing shops should be eliminated as double counting. Therefore, GDP contribution is about $47 billion (US) or around 1%.

EMPLOYEES AND SALES IN METAL FINISHING

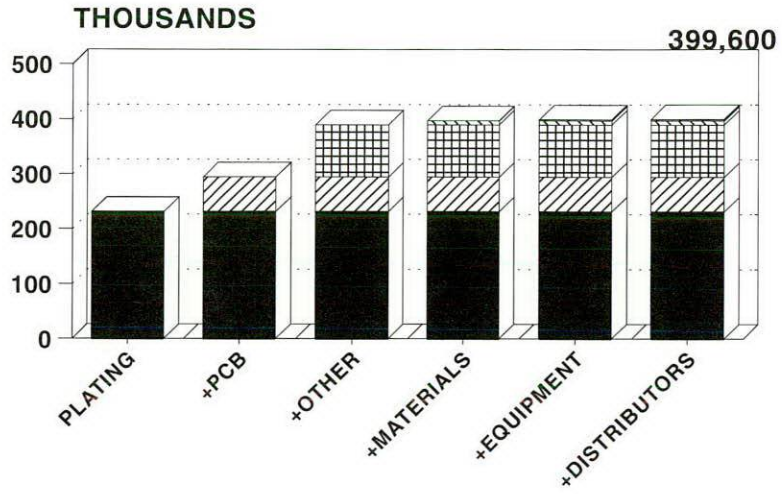
CATEGORY	FIRMS	STAFF	SALES/ PERSON	SALES ($ BILLION)
JOB & CAPTIVE SHOPS				
•PLATING	7,000	231,000	$147,500	$34.1
•PCB	820	63,500	$86,000	$5.5
•OTHER FINISHING	2,800	95,000	$80,000	$7.6
MATERIALS & EQUIPMENT				
•FINISHING MATERIALS	180	7,400	$368,000	$2.7
•FINISHING EQUIPMENT	100	2,100	$354,000	$0.7
•DISTRIBUTORS	200	600	$1,000,000	$0.6
•OTHER MATERIALS	?	?	?	$4.5
TOTALS	11,100	399,600		$55.7

NORTH AMERICA NUMBER OF FINISHING FIRMS

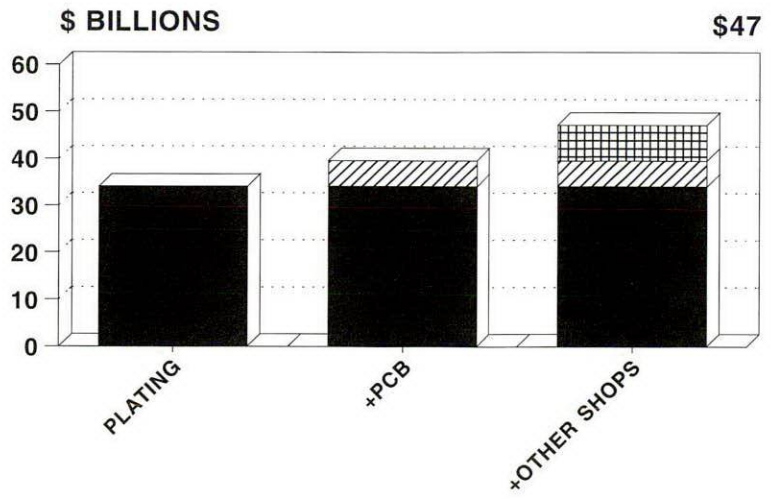


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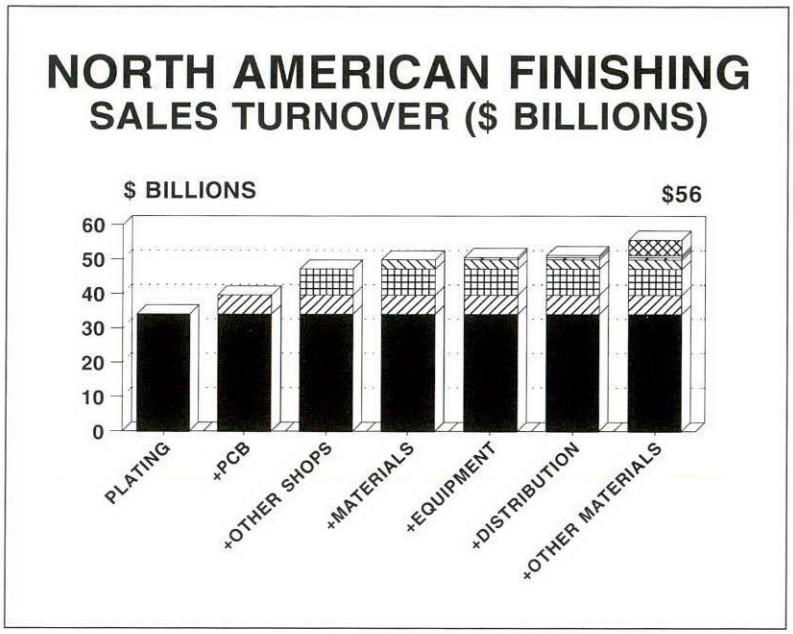
NORTH AMERICA
NUMBER OF FINISHING EMPLOYEES



NORTH AMERICAN FINISHING
GDP CONTRIBUTION ($ BILLIONS)



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Probably the most profound change in the table above from the initial report is the statistic on sales/employee for plating shops. This is up to $147,500 from $82,500/employee. This is entirely due to the captive shops reporting increased sales of about $215,000/metal finishing employee vs. $80,000 at job shops. This is clearly an area that needs considerable review in future periods as it generates a difference of about $10.2 billion in sales in the industry. Given the limited response from captive shops, there was no easy way for the SFMRB to confirm or revise this statistic.

The "Other Finishing" category in the table above is estimated based on the portion of the net mailing list items, which could not be identified as PCB or Plating. Presumably, this includes powder coaters, phosphatizers, painters, anodizers, coil coaters, mechanical finishers, vacuum coaters, etc. In order to estimate their employment and sales/employee, the most recent values for metal finishing job shops were used.

The SFMRB, as in the initial report, still estimates there are 180 proprietary material manufacturers or mixed manufacturers and distributors. In this report a new category of pure distributors, about 200, has been added. Since distributors normally work with commodity materials on small margins, the sales/employee for pure distributors tends to be quite high at $1 million. The total of 480 combined manufacturers, distributors, and equipment suppliers is much less than the mailing list count of 1735. This difference is ascribed to the presence of consultants, laboratories, etc. on the supplier list who are not counted in these statistics. Also many companies are on the list, but are very minor suppliers to the metal finishing industry.

Probably the most uncertain number in this summary is the "Other Materials". The job shops have responded that 24% of their expenses relate to materials, up from 14% in the initial report. While the SFMRB may doubt the higher number, it was used to establish total materials bought by the job and captive shops at $7.9 billion. When you subtract away the equipment and materials accounted for from manufacturers and distributors, a residue of $4.5 billion remains. This is reported above. Presumably this relates to non-specific metal finishing materials like janitorial supplies, office supplies, packaging, etc. No analysis of the suppliers of other materials was conducted in this year's survey.

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Future

Next year's objectives for the SFMRB include:

1. Achieving better participation from captive shops, equipment suppliers, and materials suppliers. This may include expanding on the "expert' estimating process for more markets.

2. Involve more anode suppliers and the manufacturer/distributors of sodium hypophosphite (for electroless nickel) in order to build a second universe to use with the process economic statistics.

3. Improving the quality of process economic data to provide more cross checking of the total market size estimates.

4. Expanding into selected technology trends analysis.

5. Increasing direct support for the combined government relations operations of the three sponsoring societies.

6. Getting a better handle on the role that distributors play in our industry.

7. Solicit more suggestions and volunteers.

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Dick Crain	MFSA
Mike D'Angelo	MacDermid Inc.
Duff Gerhardt	General Super Plating
Curtis Goad	Goad Co.
Gregg Hadgis	Areway Inc.
Dick Kessler	LeaRonal
Ken Lemke	Plating Systems Inc.
David Lucas (Consultant)	D. K. Lucas & Associates
David Marsh	Marsh Plating
B.J. Mason	Mid-Atlantic Finishing
Bob McDowell	McDowell Enterprises
Mike Murphy	Metal Finishing Magazine
Brad Parcells	NAMF
Jerry Poll	Products Finishing Magazine
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INDUSTRY
MARKET SURVEY

1992-1993

ENDORSED BY:

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1992-1993

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EXECUTIVE SUMMARY

For some time there has been a need to statistically define the current size and status of the metal finishing industry in North America. It was agreed by both suppliers and job shop metal finishers that this would help most of those involved in the industry with their financial and congressional credibility as well as for their own planning efforts. To this end, the SFMRB was formed early in 1993 by members of NAMF, MFSA and their invited guests, under the guidance of IPC.

The SFMRB, with the cooperation of all the key associations and trade journals, created a comprehensive, merged mailing list of 13,600 metal finishers and 1950 metal finishing suppliers. Four different, customized survey forms were designed by the committee to obtain information from job shop finishers, captive finishers, consumable material suppliers and equipment suppliers. The forms were mailed to a majority of the mailing list in September, 1993. A system to maintain confidentiality of all information was designed using a CPA firm. By the end of 1993, 276 usable completed survey forms were received and analysis began.

Statistically significant reported data was used to calculate scaled-up industry results using three different statistics as a cross check. The key findings of the analysis of the survey data, related only to the metal finishing industry, are:

° The total metal finishing industry is estimated to employ nearly 520,000 people with an annual GDP contribution of nearly $47 billion, 1% of the U.S. total.

° Three-quarters of the metal finishing industry believes business will improve in 1994; 15% think it will be worse and 10% that it will remain unchanged from 1992-3.

° Average factory sizes are 24,000 square feet for equipment suppliers, 35,000 for job shop finishers and 43,000 for consumable material suppliers.

° Job shop metal finishers average 34.5 employees; captives 50; material suppliers 39.5 and equipment suppliers 18.5.

° The average job shop has $2.5 million in annual sales revenue; the average material supplier $7 million and the average equipment supplier $1.9 million.

° Job shop metal finishers average sales per employee are $75-88,000; material suppliers $177-183,000 and equipment suppliers $102-106,000.

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° The average metal finishing facility plates approximately 2 million square feet per year. Mild steel is the dominant substrate with 59% followed by copper alloys (14%), hard steel (9%) aluminum (7%) and plastics(6%). Zinc diecasting is believed to be under-represented.

° There is an average of 2.2 plating lines per facility, with 66% manual. Thirty-seven percent are barrel, 31% rack and the balance use both.

° In North America it is estimated that there are 6750 plating facilities (captive and job shop), employing 285,000 people with an annual gross domestic product contribution of $23.6 billion.

° The automotive market segment demand dominates with a 40% share of all finishers' business, followed by consumer durables and electronics each with approximately 10%. Electronics is believed to be under-represented.

° Job shop reported costs are:

-Labor, 28%

-Material, 14%

-Environmental, 5%

-Safety and Health, 2.5%

° An estimate for the 4180 other finishers, including anodizers, buffers, antiquers, polishers, etc., is that they employ 176,000 people with a gross domestic product contribution of $14.6 billion.

° The 680 metal finishing proprietary material and equipment suppliers are estimated to employ 16,000 people with a gross domestic product contribution of $2.3 billion.

° Material suppliers each serve about 275 customers annually while each equipment supplier serves approximately 150.

° The average finisher spends $85,000 annually on equipment or 3.5% of annual revenue.

In future years, a broader cooperation from all segments of the metal finishing industry will be encouraged, to enable the SFMRB to report improved, more comprehensive and more accurate data on the industry.

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STATUS OF THE INDUSTRY

In the last two decades the metal finishing industry in North America has been groping for direction, buffeted by the winds of economic, technical, and environmental change, and has lacked a clear idea of exactly where it is.

The most difficult, yet most important, job of a navigator is to learn where he or she stands. An industry in transition finds the task of managing its changes infinitely harder if basic statistical information is lacking. How do you set a course, when you don't know where you are?

Lacking basic statistics on your industry, how do you convince your bank to lend money for investments in more productive plant and equipment? How do you tell your Congressional representatives the number of jobs affected by pending legislation, and the contribution made to the GDP by the industry? Where can you obtain information on new markets and growth areas? The Surface Finishing Market Research Board (SFMRB) was created to help answer these questions.

The concept for the SFMRB was first conceived in April of 1991 within the Metal Finishing Supplier's Association (MFSA). On January 8th, 1993 a meeting was called by MFSA, with representatives of the American Electroplaters and Surface Finishers Society (AESF), the Institute for Interconnecting and Packaging Electronic Circuits (IPC), and the National Association of Metal Finishers (NAMF) invited to attend. The purpose of the meeting was to establish a plan of action for the SFMRB, modeled after the Technical/Marketing Research Committee (T/MRC) of IPC.

The meeting was hosted by IPC at its headquarters in Lincolnwood, Illinois. The objective would be to obtain information relating to the size of the market for surface finishing, including sales of equipment and materials, sales and markets for finishing services, and employment within the finishing industry. One of the first considerations was to decide how best to get meaningful statistics, and how to fund the effort. A number of proposals were discussed.

At their respective meetings in January and February of 1993,the boards of MFSA, NAMF and AESF were presented with a request for funding, based on the use of survey forms. NAMF and MFSA subsequently approved the requests and formally announced the formation of the SFMRB. Jointly funded by the two organizations, the mission of the SFMRB was defined to undertake a two-year effort to develop and refine a detailed information base about the current status and

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future trends of the surface finishing industry. It was anticipated that the information developed would help both metal finishers and their suppliers make better decisions regarding areas for business development, as well as provide the industry with more detailed information regarding employment and industry activity for use in presentation to governmental and regulatory bodies.

The results of the first year of the project are being presented at the inaugural joint convention of the American Society of Electroplated Plastics (ASEP), NAMF, and MFSA to be held at Hilton Head, South Carolina in March, 1994.

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METHODOLOGY

A steering committee composed of representatives from the NAMF and MFSA, along with invited guests, met in June of 1993 in Anaheim, during the AESF SurFin® conference to discuss details for implementation of the plans approved by the respective boards. Mr. Howard Smith of Atotech USA was designated as committee chairman. It was established that a series of four mail surveys would be conducted with questionnaires designed to permit scale-up of the data and cross checking between users and suppliers. The four survey groups to be included were job shop finishers, captive finishing shops, equipment vendors, and material suppliers. Copies of the forms used are available from MFSA headquarters.

All data received would be treated as confidential. Individual companies would return completed forms to a CPA, who would then remove all identifying information and code each response. Participants would be entitled to a summary of the results and for this purpose the CPA would retain a listing and also endeavor to eliminate duplicate forms insofar as possible.

The purpose of the questionnaires was to provide information that would determine the size of the industry in terms of number of installations where finishing is performed, the number of employees at these locations, consumption of chemicals, sales value, and related data. Technology and market trends, costs for pollution control, etc. would also be explored.

In order to obtain the most complete listing possible, the related trade associations and major trade publications were asked to participate by contributing the use of their mailing lists. *Metal Finishing , Products Finishing and Finishers Management* agreed to supply their lists, as did AESF and ASEP. The lists were supplied to a bonded mailing house along with those of NAMF, AESP and MFSA. Duplicate entries were eliminated where possible. Mailings were then made in the fall of 1993 to a broad selection of the merged listings in the four categories.

Respondents in the U.S.A. and Canada were asked to supply information related to electroplating, etching, anodizing, printed circuit board fabrication, connector and semiconductor manufacturing; but not painting, powder coating, phosphating, coil coating, and vacuum coating operations.

Job shops and suppliers were asked to supply sales data for 1992 and the first half of 1993. All respondents were asked about employment related to metal finishing.

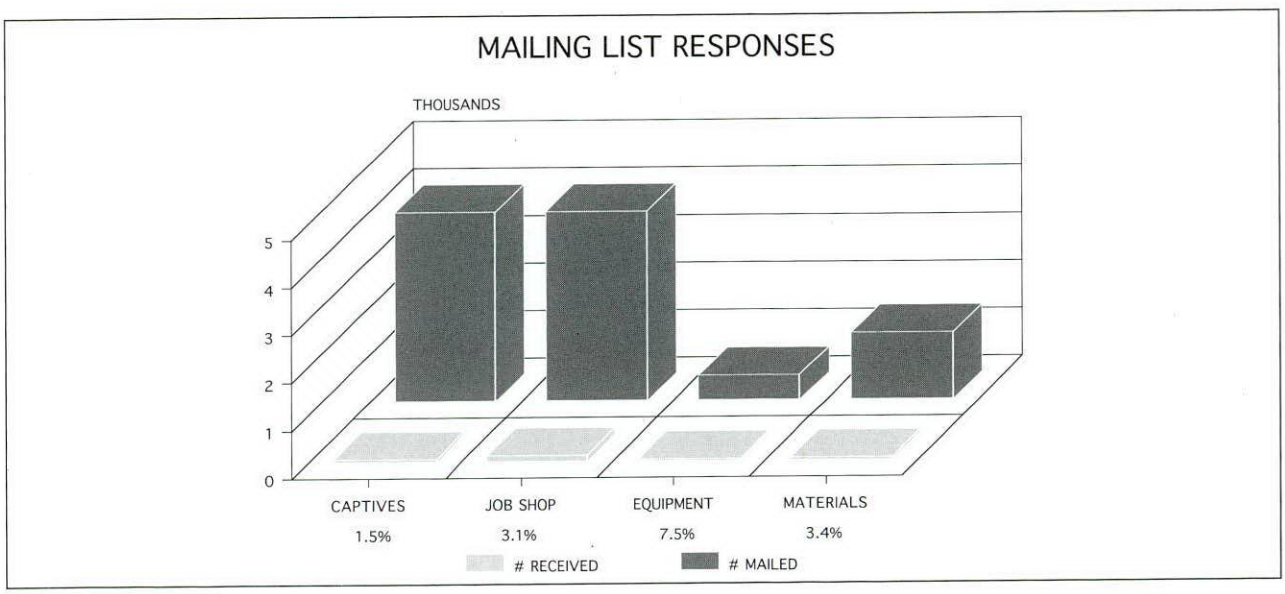
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The user surveys requested data on processes and equipment, while the suppliers were asked to provide details on sales of equipment, chemicals and materials in various categories.

The basic assumption behind the planned use of these statistics was to have a three-way cross check. If at least 25 shops submitted user statistics for any single process, one could assume a meaningful average was obtained based on a normal distribution of results. If the universe (i.e., total industry use) of proprietary chemicals, chemical salts, or anodes is known, then it should be possible to scale up to the total industry activity for that process. If all three scaling factors are known, up to three estimates of the industry totals are possible. This logic implied the need for the SFMRB to achieve nearly complete cooperation of the consumable suppliers and broad response from shops using the various processes.

Completed questionnaires were mailed by the respondents to S.R. Snodgrass & Co., Certified Public Accountants, of Mentor, Ohio. The firm numbered each response, and removed the section giving company name, and address to maintain confidentiality. Numbered forms were submitted to the consultant, David Lucas, D. K. Lucas & Associates of Jensen Beach, Florida for analysis and preparation of a report.

The following table gives details on the size of the merged mailing list (total list) for each category, the number of questionnaires mailed, the total number of responses, and the number of usable responses for each of the four categories. A usable response was simply one that contained sufficient information to be worthy of tallying.



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Mailing List/Responses

Category	Total List	Total Mailed	Responses	Usable Responses	Usable % of Total Mailing
Captives	7212	4000	297	59	1.5%
Job Shops	6409	4000	295	123	3.1%
Equipment Suppliers	541	541	71*	41	7.5%
Material Suppliers	1425	1425	291*	53	3.4%

(* Includes distributors who should not have responded)

Follow up mailings and phone calls were conducted to improve the volume of usable responses, which ranged from 1.5 to 7.5 percent. Typical industry responses to mail surveys of this type range from 1.5 to 6 percent, so the results were within the acceptable range, although the captive shops were at the low end of the range. During analysis of the data it was noted that responses from printed circuit fabricators were also low.

Databases were established on a personal computer and the data screened for consistency and completeness. Since there was a relatively small response from Canada, it was decided to treat data submitted in Canadian dollars as equivalent to U.S. dollars. There was some discrepancy noted in the reporting of 1993 first half sales, as some respondents obviously inserted full year values. These were adjusted, taking into consideration other information provided, such as trends, projections, and employment levels.

Considering the quality and quantity of the responses, SFMRB believes the values reported to be plus or minus 10-20 percent of reality.

Additional information, collected during the survey, but not included in the report, has been retained and may be available from MFSA or NAMF.

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PLANT LOCATIONS

Each of the four surveys requested that respondents include a zip code so that information could be provided as to the location of plant sites. The table below summarizes the percentage of plant sites for captive and job shop finishers and for the suppliers in eight geographical regions in the U.S. and Canada.

Nearly 42% of the responding plating shops and suppliers are located in the central region, Ohio to Missouri, Indiana to Wisconsin. The Atlantic Coast, which is from Pennsylvania and New Jersey through the Carolinas are next with about 25%. New England and the Pacific Coast areas were third with 10-12%. In general, job shops responded with usable data more than did captive shops. Supplier locations tended to roughly follow the same pattern, with the exceptions of the Pacific Coast, which was lower, and New England, which was especially higher.

Locations of Responders

Geographic Area	Captive and Job Shops	Suppliers
New England	7.8%	13.0%
Mid Atlantic	15.5%	19.8%
Southeast	5.5%	13.2%
East Central	26.1%	23.6%
West Central	16.7%	15.1%
Southwest	3.9%	0.9%
Mountain	2.8%	2.8%
Pacific Coast	15.0%	5.7%
Canada	6.7%	5.7%

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BUSINESS TRENDS

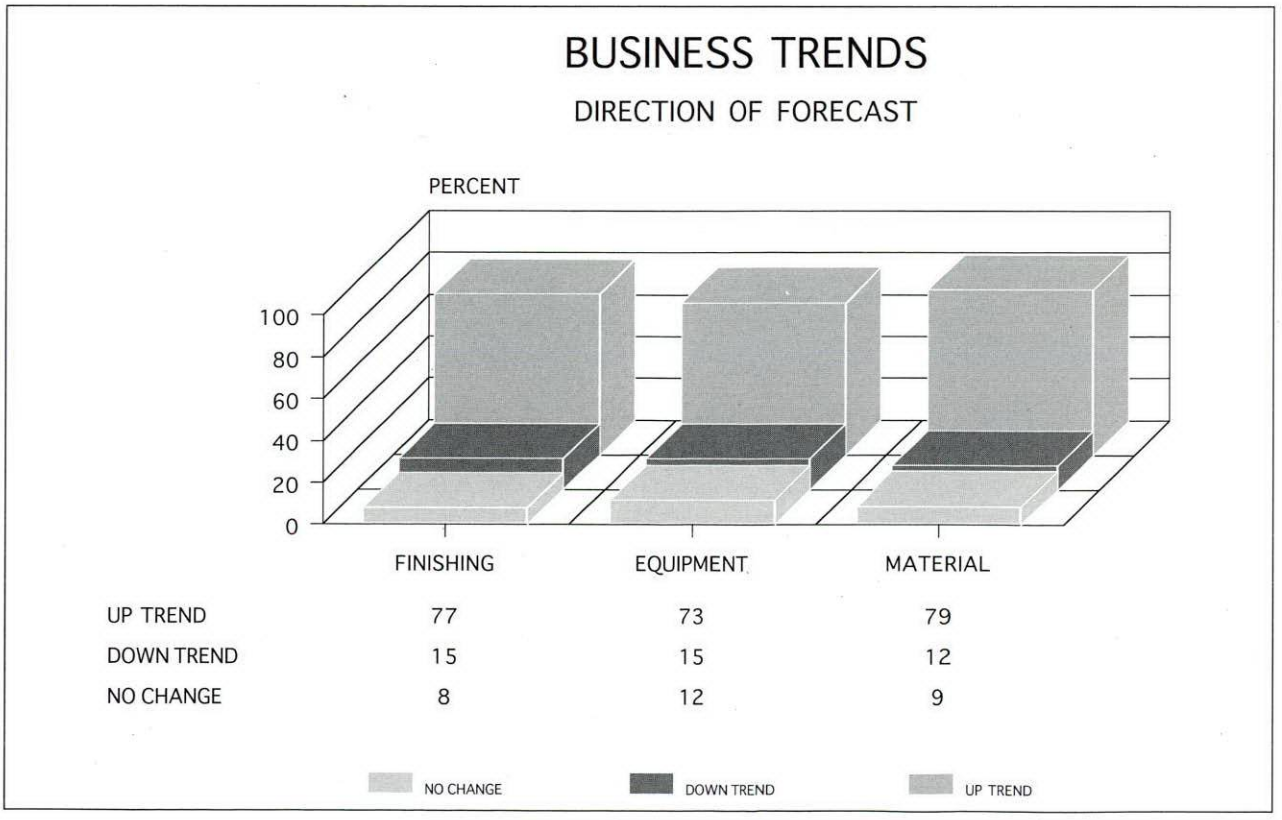
The general and categorical trends, summarized in the tables below, are based on responses from 172 job and captive shops, 52 material suppliers and 40 equipment suppliers.

Three quarters of all respondents forecasted an upturn in business and only 12-15% expect a downturn in 1994. The balance forecasted no change.

Business Trends
(Direction of Forecasts)

	Finishing	Equipment	Material
Business Up	77%	73%	79%
Business Down	15%	15%	12%
Business Unchanged	8%	12%	9%

The finishing shops, who forecasted an increase in 1994 business, averaged 30% up. Those forecasting a decrease averaged 27% down. The supplier-forecasted increases and decreases were a less radical 18% up and 14% down.

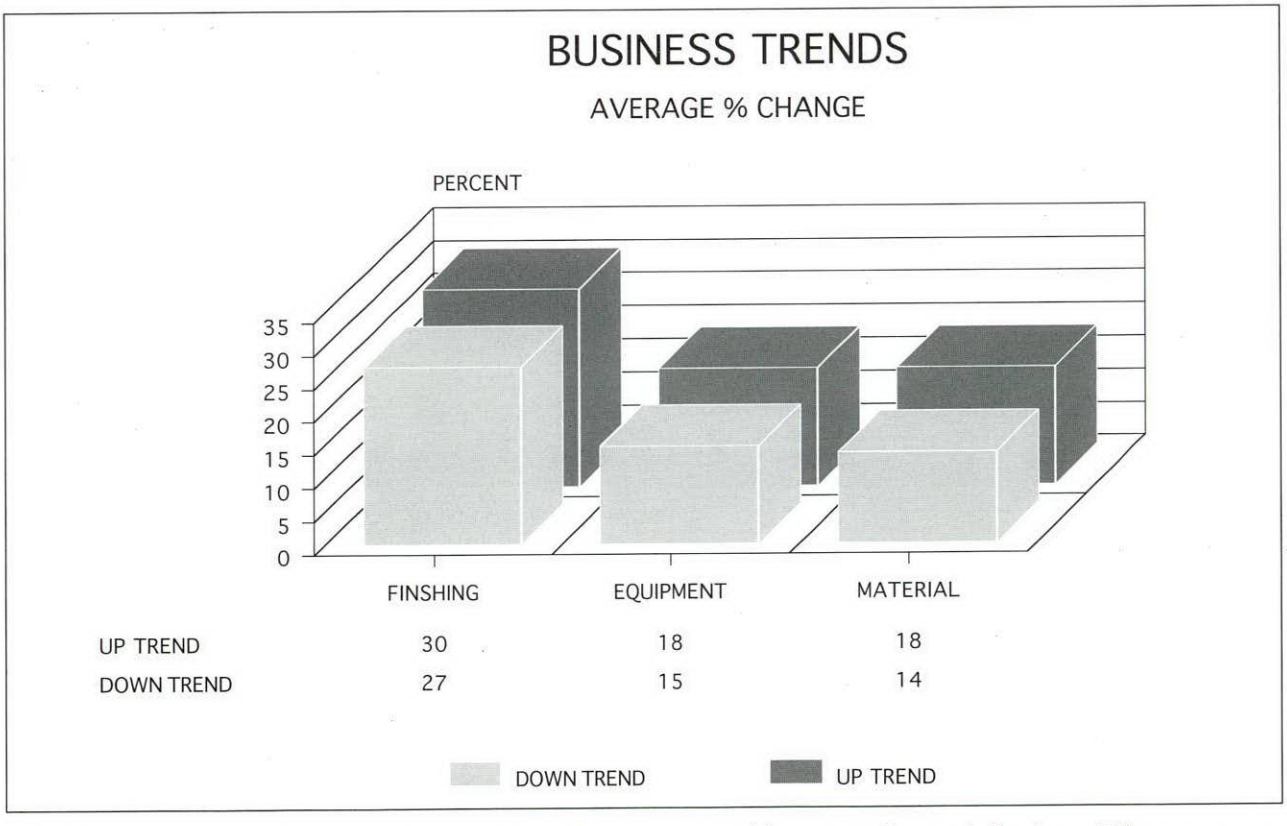


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Business Trends
(Ave.% Change)

	Finishing Shops	Equipment Suppliers	Material Suppliers
Business Up	30%	18%	18%
Business Down	27%	15%	14%

Finishing shops most frequently anticipate their business growth to come by taking business from their U.S. and Canadian competitors and from the general upswing of the economy. Captive shops out-sourcing was also mentioned by almost a third of all respondents.



Equipment suppliers most mentioned an upward impact from Mexico. They were the only group to think NAFTA will have an effect soon. U.S./Canadian competition and improving economic conditions were almost as important to the equipment companies.

Consumable material suppliers mainly expect increases in their business to come from their U.S. and Canadian competitors. Second in mentions (of 25-33% each) was overall economic growth, Mexico (despite NAFTA) and out-sourcing.

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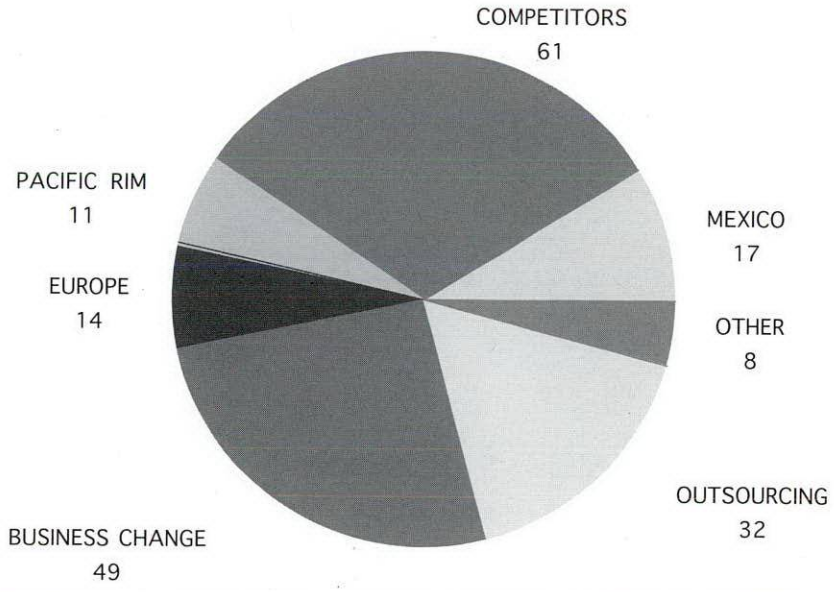
Increasing Business (Categories)

Source of Increase	Finishing Shops	Equipment Suppliers	Material Suppliers
Mexico	17%	43%	28%
U.S./Can. Competitors	61%	38%	63%
Pacific Rim	11%	8%	25%
Europe	14%	15%	12%
Change in Bus. Cond.	49%	35%	33%
Out-sourcing	32%	3%	20%
Other	8%	13%	29%

(Multiple responses from some respondents gave values in this table exceeding 100%)

INCREASING BUSINESS

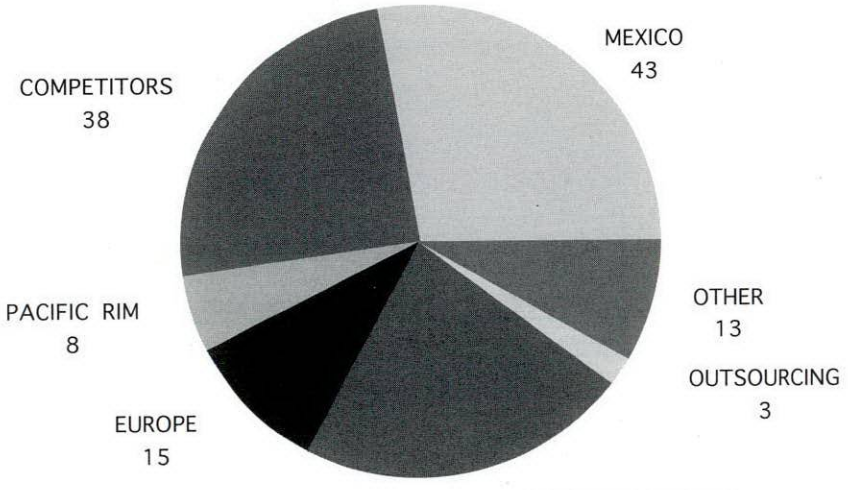
FINISHING SHOPS (%)



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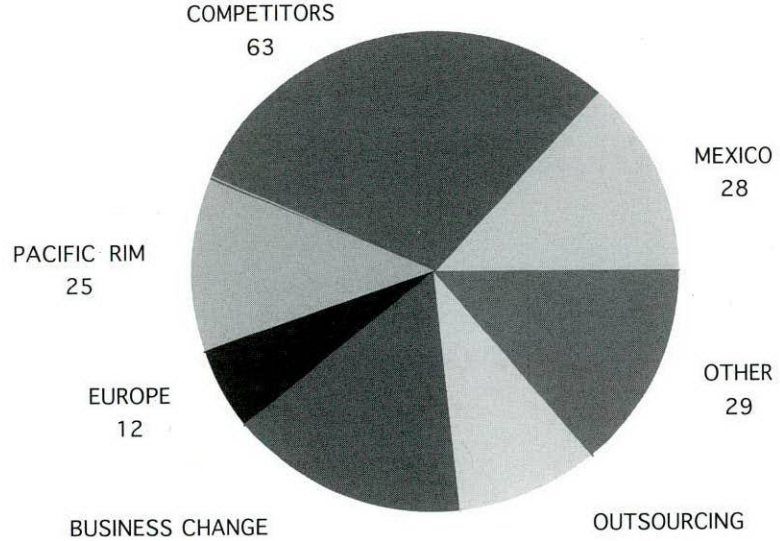
INCREASING BUSINESS

EQUIPMENT SUPPLIERS (%)



INCREASING BUSINESS

MATERIAL SUPPLIERS (%)



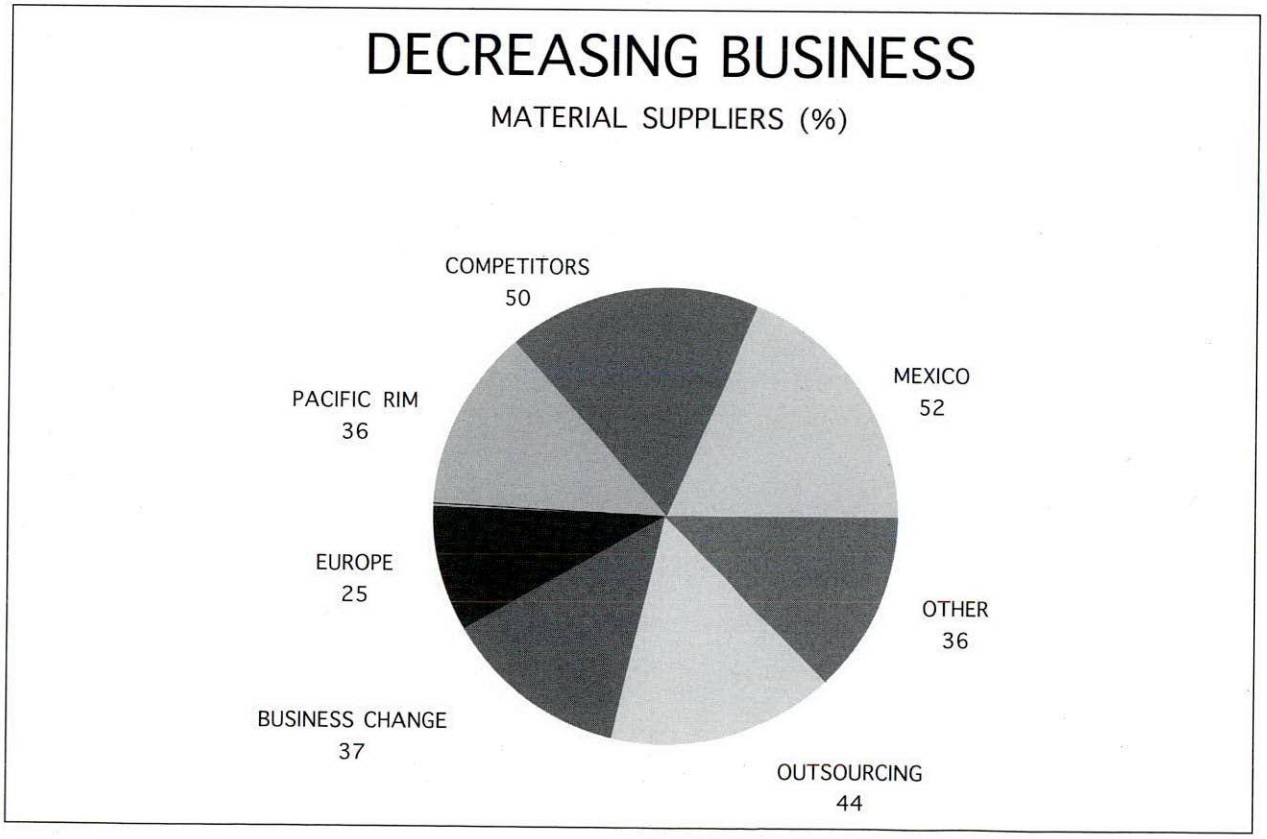
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Decreased finisher business forecasts seemed predominantly driven by expected changes in business conditions due to sector shrinkage. The government, aerospace and electronics sectors were mentioned most. About equally mentioned as a business shrinkage reason was competition from U.S./Canada and from Mexico. Surprisingly, the Pacific Rim seemed of less concern than Europe as a factor for either growth or shrinkage.

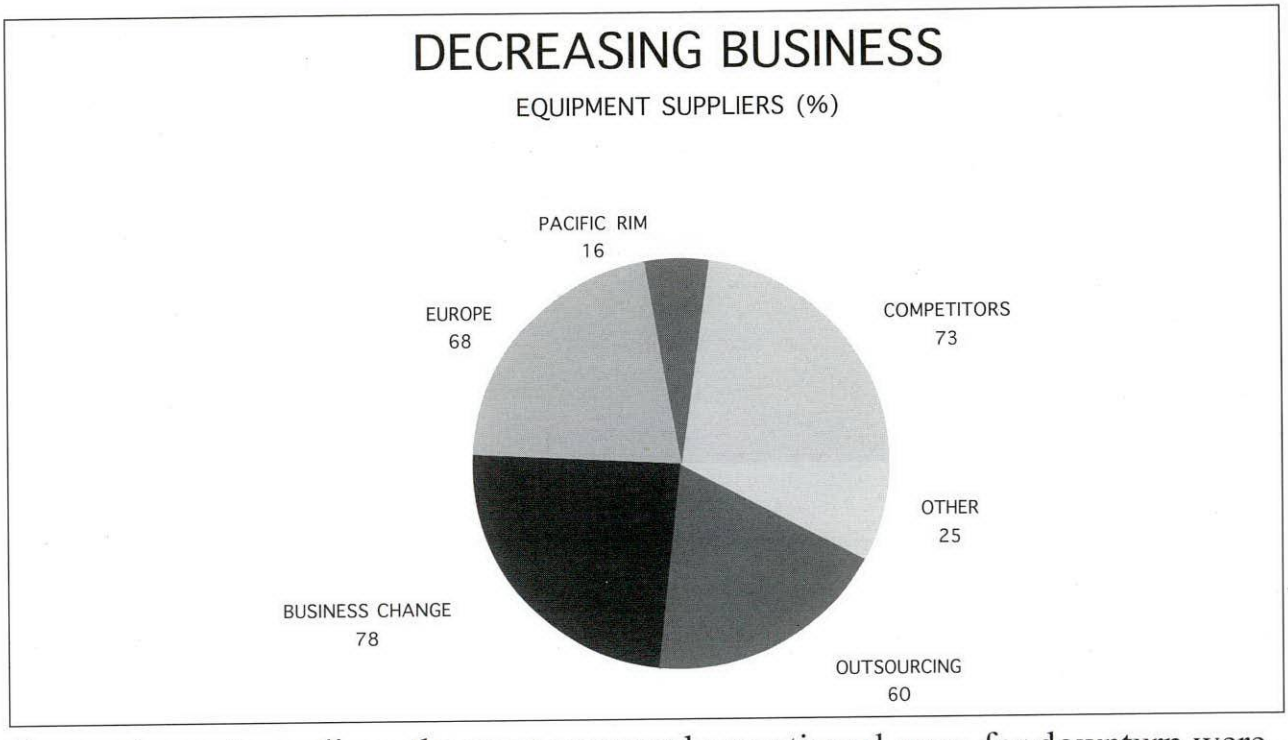
Decreasing Business Categories

Source of Decrease	Finishing Shops	Equipment Suppliers	Material Suppliers
Mexico	42%	0%	52%
U.S./Can. Competitors	42%	73%	50%
Pacific Rim	15%	16%	36%
Europe	19%	68%	25%
Change in Bus. Cond.	81%	78%	37%
Out-Sourcing	19%	60%	44%
Other	8%	25%	36%

(Multiple responses from some respondents gave values in this table exceeding 100%)

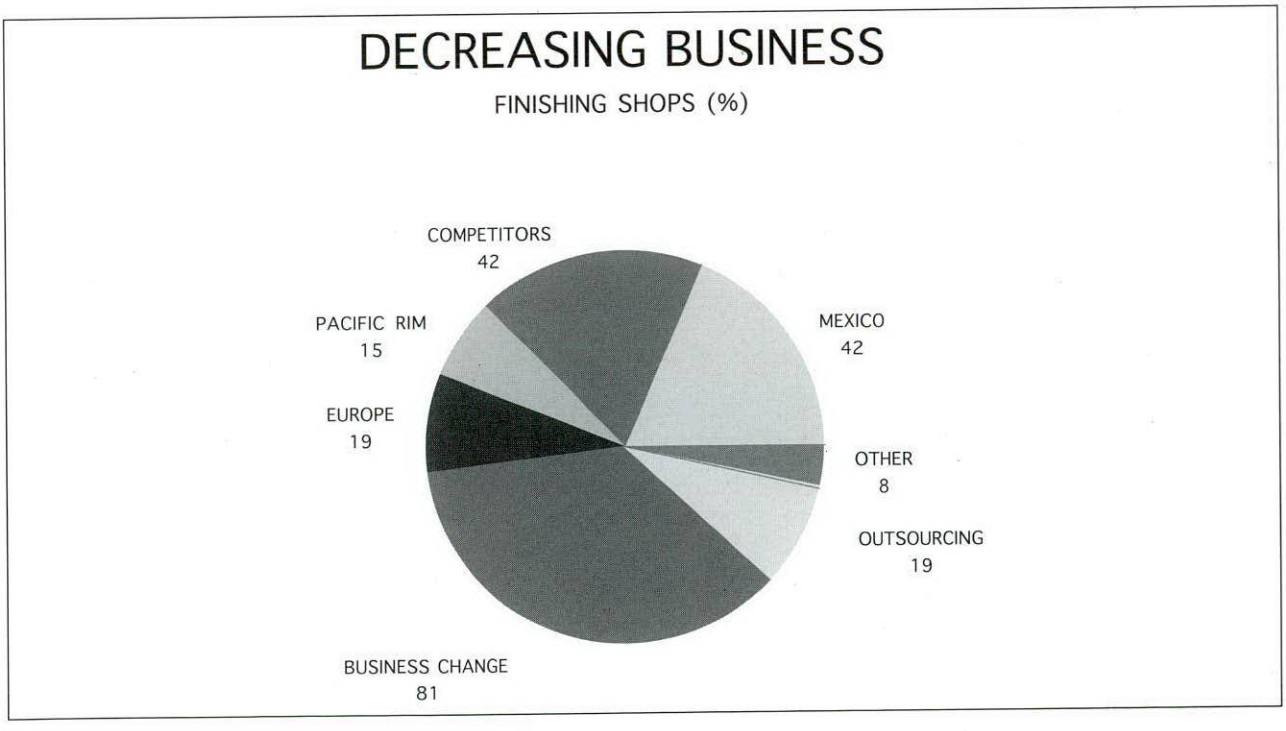


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For equipment suppliers, the most commonly mentioned areas for downturn were, as with finishers, sector shrinkage, North American competitors, European competitors and out-sourcing by captives.

The main downward business pressures reported by consumable material suppliers were effects from Mexico, their U.S./Canadian competition and fears of direct competition from out-sourcing by captives.



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JOB AND CAPTIVE SHOPS

Employment and Sales

Useful responses were received from 123 job shops. However, since some of the useful questionnaire responses were not complete, the employee statistics summarized below cover only those shops providing both employee and total sales data. The growth in employment is consistent with the general optimism about the 1994 economy. Averaging the 1992 and 1993 responses, the typical job shop produces an annual average revenue of $82,500/ employee. (NOTE: The 1993 numbers in this report have not been adjusted for inflation.)

Job Shop Employee Statistics

Year	No. Job Shops	Total Employees	Avg. Employees per Job Shop	Avg. Sales per Employee
1992	117	3717	32	$76,300
1993	117	4280	37	$88,700

Useful responses were received from 59 captive shops. The table below gives an indication of the averages and medians relative to the employment levels by all finishing shop respondents.

Surprisingly the 80/20 rule does not seem to apply to finishing shop size or employment, based on the 1992 reported data. Small shops are more numerous than one might expect from an industry that is mature, transportation radius sensitive and not highly differentiated. The median value is the point where 50% of the responses are above and 50% are below that value. The average job shop had 32 employees in contrast to captive shops which averaged 50.

Employment in Metal Finishing Shops
(1992)

	Job Shops	Captive Shops
Number reporting	117	54
Total MF Employees	3717	2687
Average	32	50
Median	17	15

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Sales volume for job shops is summarized below. Captive shop sales were not requested as it was felt that the information could be misleading. These average sales/shop levels with the above average employees/shop and the average sales/employee ratios proved to be very useful in our later scale-up analyses.

Sales Volume for Job Shops (1992)

Total Sales	$283,546,000
Average	$2,466,000
Median	1,108,000

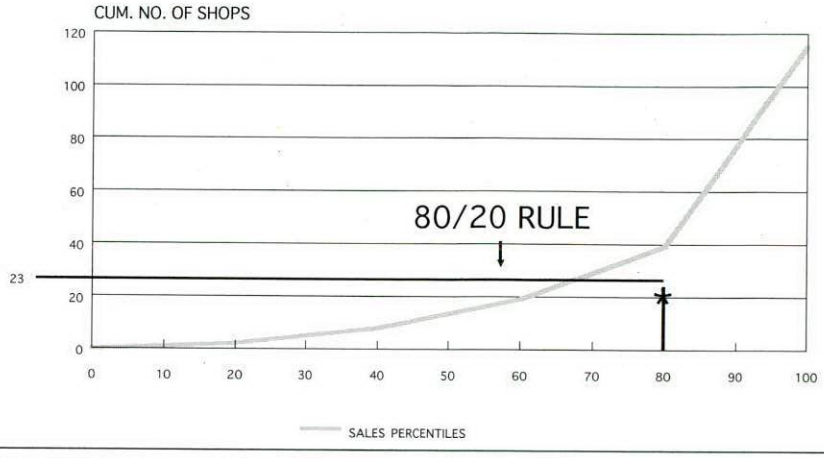
Based on 115-117 useful responses and an equal weighting to sales and employees, the responding job shop finishers were ranked into 5 equal percentile groups (highest to lowest). This analysis indicates that a majority of the respondents to the survey were below the averages and medians mentioned above. Also, the data indicates that the 80/20 rule does not apply in that the top 20% of respondees only account for 65% of sales and employees. This is typical of a mature job shop industry. However, the 80/20 rule is closer to the data reported for captive finishers.

Size of Finishing Shops

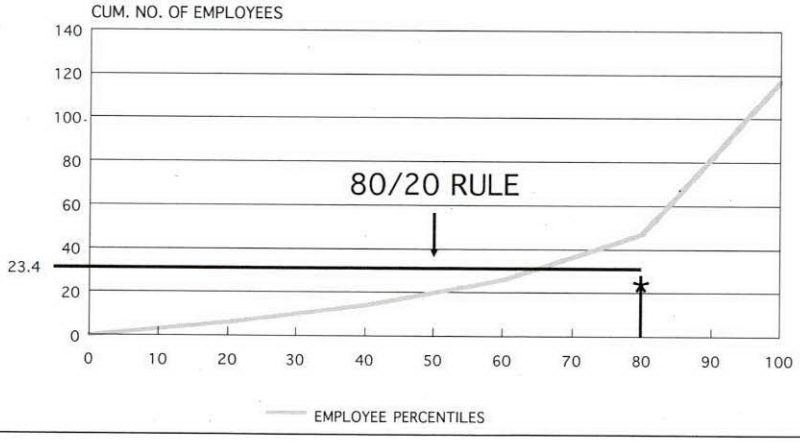
Percentile	No. Job Shops (by Sales)	No. Job Shops (by Total Employees)	No. Captive Shops (by Metal Finishing Employees
20%	2	6	1
40%	6	8	3
60%	11	12	2
80%	20	21	6
100%	76	70	42
Totals	**115**	**117**	**54**

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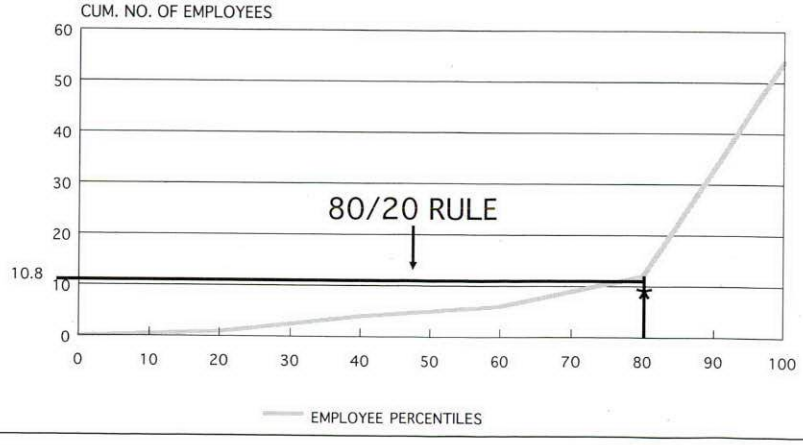
SIZE OF JOB SHOPS
SALES DISTRIBUTION IN PERCENTILES



SIZE OF JOB SHOPS
TOTAL EMPLOYEES IN PERCENTILES



SIZE OF CAPTIVE SHOPS
TOTAL EMPLOYEES IN PERCENTILES



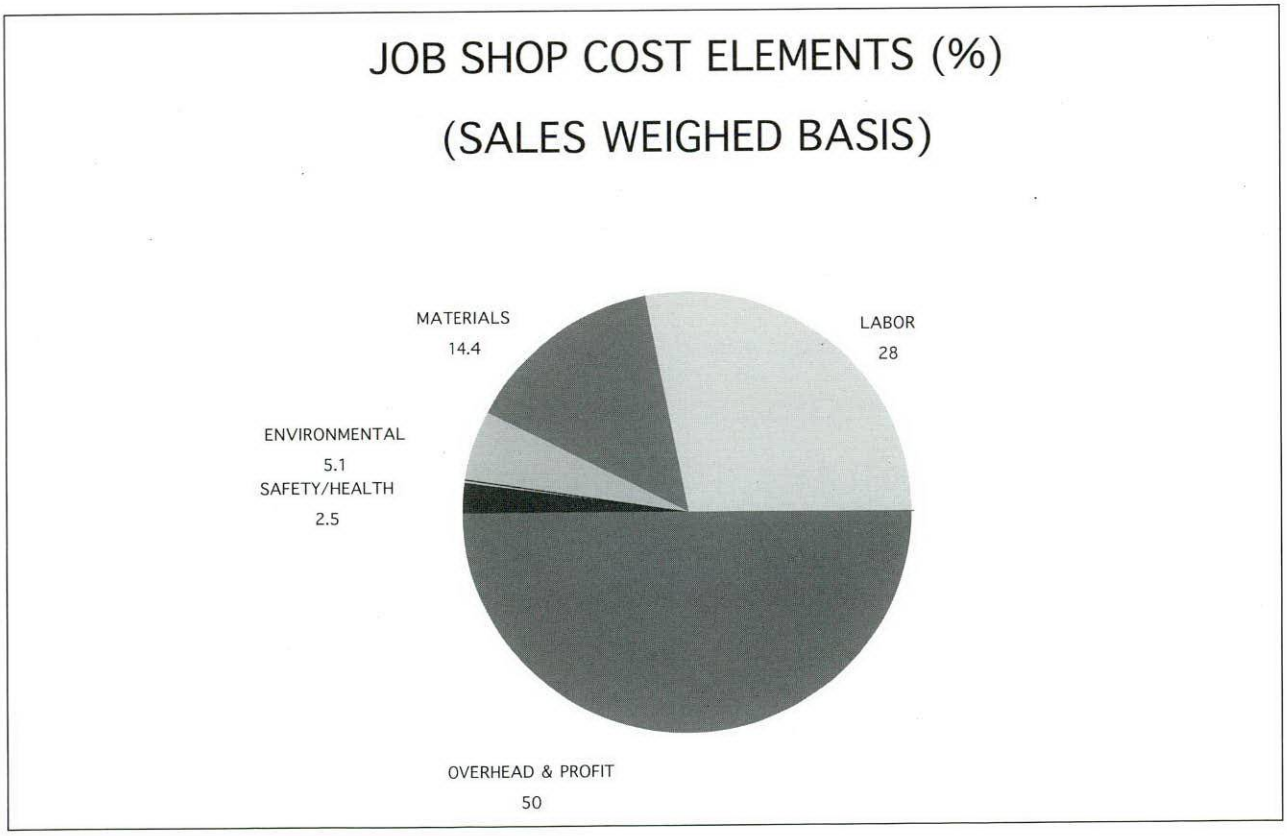
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Job Shop Costs

Based on both the average response, and the sales-weighted average response, job shops reported typical direct labor costs of 25-28%, direct material costs of 13-14%, environmental costs of about 5% and OSHA/Safety costs of slightly less than 3%. For many shops the 8% total compliance area cost, is likely more than their pre-tax profits. (SFMRB speculation)

Job Shop Costs
(1992)

	Labor	Material	Environmental	Safety Health
Total Responses	164	162	161	150
Average %	25.3%	13.3%	5.1%	2.6%
Sales Weighted Average %	28.0%	14.4%	5.1%	2.5%



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Markets Served

The three dominant markets are automotive, consumer durables and electronics. Automotive, medical and recreational are all expected to improve with the domestic economy upturn. As the cold war priorities change it is not surprising that aerospace and government are expected to turn down. Jewelry and machine tools are also expected to turn down, which has no ready explanation.

Finisher Market Segments

Segment	1992 (sales weighted)	1993 (sales weighted)
Automotive	40.4%	47.9%
Consumer Durables	9.3%	7.9%
Recreational Goods	2.8%	3.1%
Aerospace	5.7%	4.6%
Machine Tools	4.4%	3.4%
Hydraulic Equipment	2.5%	2.0%
Electronics	10.8%	11.1%
Jewelry/Eye Glasses	3.0%	0.2%
Medical	2.2%	2.2%
Government	5.1%	4.4%
Job Shops	5.2%	7.8%
Others	8.6%	5.6%

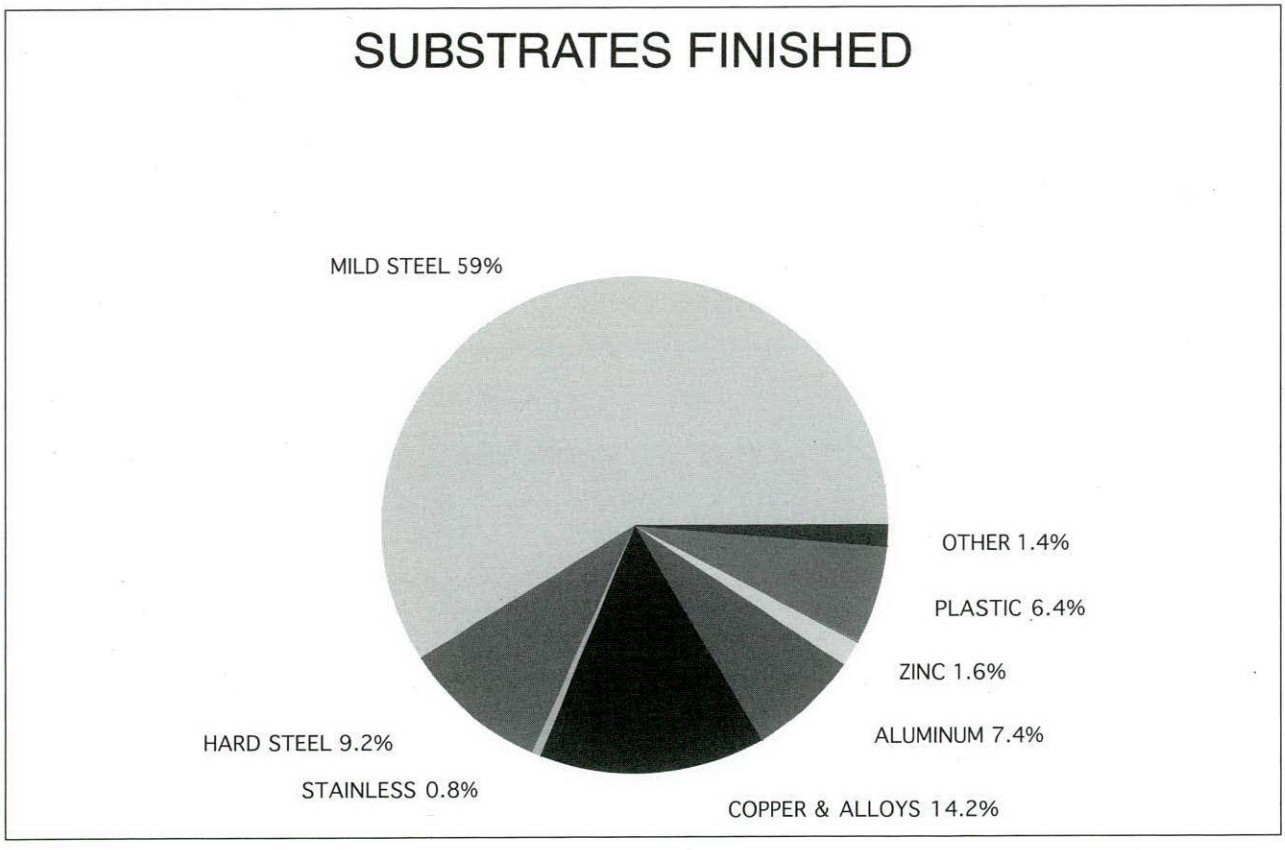
Substrates

Two hundred and forty-two facilities were reported with an annual average of 2,002,000 square foot plated per line. Metal finishing is mainly a steel substrate business accounting for 68.2% of the surface area finished. Copper and its alloys (brass, bronze, etc.) account for 14.2%, followed by aluminum at 7.4% and plastics at 6.4%. Zinc diecasting is believed to be under-reported as these substrates were often reported in pounds, not square feet. No useful conversion factor to square feet could be established.

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Metal Finishing Substrates

Mild Steel	59.0%
Hard steel	9.2%
Stainless Steel	0.8%
Copper Alloy	14.2%
Aluminum	7.4%
Zinc	1.6%
Plastic	6.4%
Other	1.4%



Metal Finishing Equipment

One hundred and sixty nine facilities were reported with an average of 2.2 plating lines per shop. The most common types of equipment were manually operated hoists, hand lines and automatic hoists respectively. These three types of equipment account for nearly 80% of the installed capacity. Although it may be related to the higher percentage reporting by job shops, equipment to run barrels only accounts for 37% of all lines. Rack lines account for 31% and the balance are either dual purpose or reel-to-reel.

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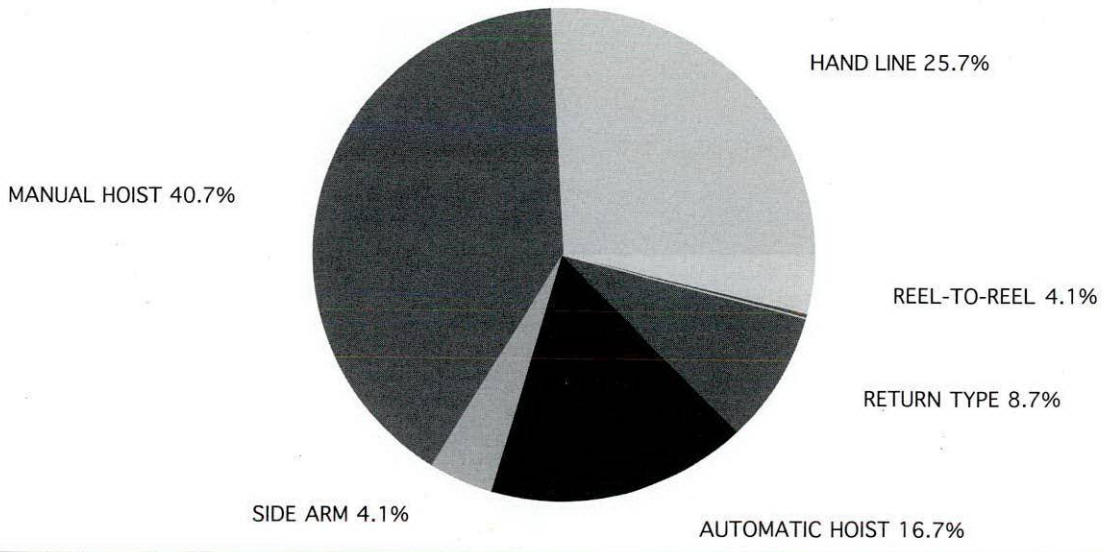
Extent of Automation in Metal Finishing Shops

Type	%
Handline	25.7%
Manual Hoist	40.7%
Sidearm	4.1%
Automatic Hoist	16.7%
Return Type	8.7%
Reel to Reel	4.1%

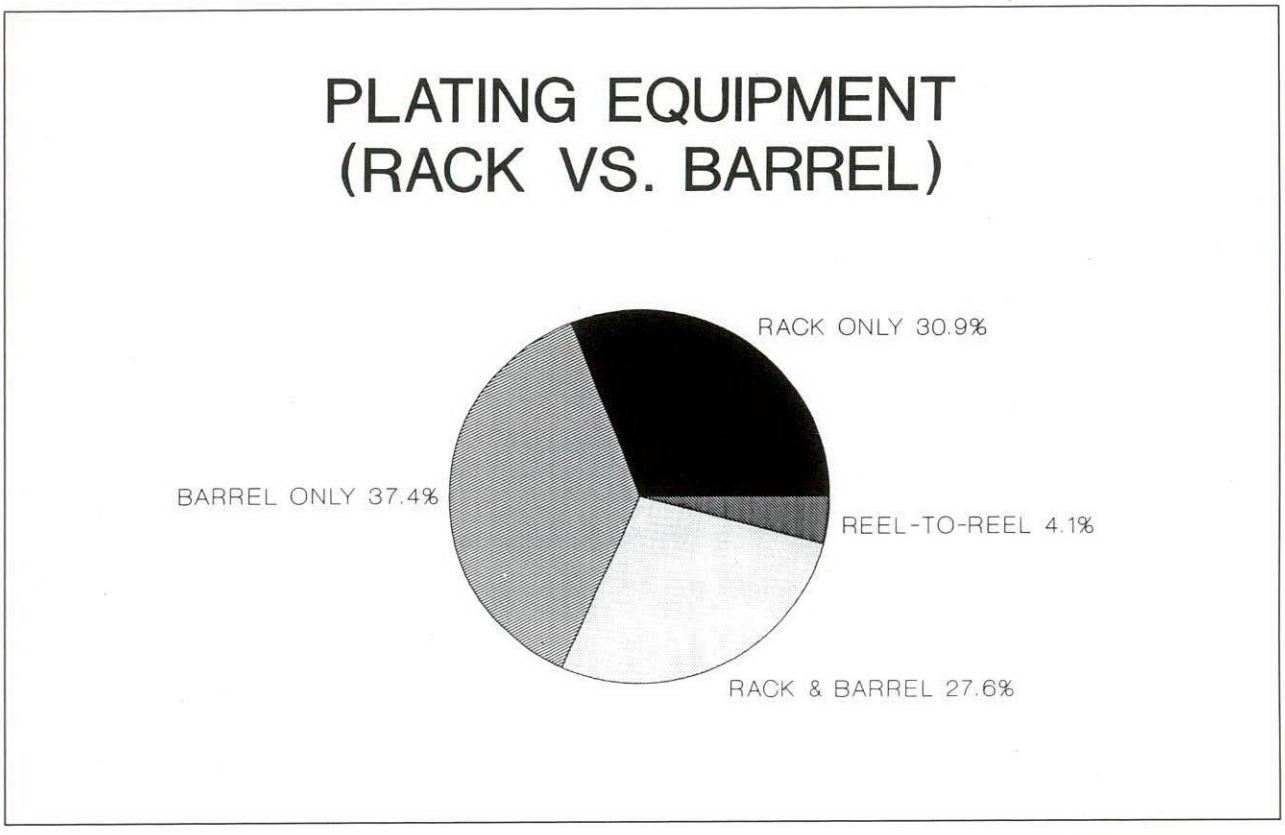
Rack vs Barrel Systems

Equipment	Percentage
Barrel Only	37.4%
Rack Only	30.9%
Reel to Reel	4.1%
Rack & Barrel	27.6%

PLATING EQUIPMENT



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Materials Usage by Finishers

The most frequently reported materials are shown below. They are listed by the descending number of shops indicating use of the material. Zinc and related materials, bright nickel, cyanide copper, and chromium plating predominate. Electroless nickel was reported by 17 users while the next most commonly used reported material was only reported by 12 users. Values for the annual consumption per tank and consumption per tank gallon are shown. There is no definition for miscellaneous surface preparations as this was the catch-all category for things that were not soak cleaners, strippers, electrocleaners, etc. The SFMRB is concerned about the accuracy (high value) of the electrolytic nickel anode data, but no obvious error in the questionnaires was found.

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Materials Usage by Finishers

Materials	Expenditures ($000)	Number Reporting	Avg.$ ($000)	Avg. $ per tank gal.
Pure zinc anodes	$730.9	46	15.9	6.62
Hex-Cr	$141.1	40	3.5	4.42
Bright Ni	$801.5	39	20.6	9.75
Acid Zn e-galvanizing	$802.1	26	30.8	9.92
Chromic acid	$139.9	26	5.4	3.52
Catalyst with chromic acid	$156.2	24	6.5	4.77
Cyanide Cu	$77.4	23	3.4	3.08
Electrolytic Ni anodes	$2505.0	22	113.9	32.34
Misc. surface preps.	$2176.5	22	98.9	43.51
Sodium cyanide	$100.7	20	5.0	2.93
Trivalent chromates	$56.8	20	2.8	7.37
Electroless Ni	$616.3	17	36.3	88.29

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MATERIAL SUPPLIERS

Proprietary Chemicals

In order to avoid any risk of competitive information being publicly divulged in this study, only those materials with 10 or more suppliers reporting are shown below. The most frequently sold products tend to be cleaners, electroless nickel, zinc plating materials and their related chromates, bright nickel, and coppers—cyanide and acid. Only 1992 data is shown as there were problems with some of the 1993 data being doubled to full year values in a fraction of the questionnaires. In terms of sales value, the electroless nickels and bright nickels are the largest shown. Nickel anodes would be in the same order of magnitude, but are omitted here because of the small number of importers or manufacturers.

SFMRB believes that about two-thirds of the large and middle sized suppliers reported their data.

Sales by Material Suppliers

Material ($000)	1992 Sales Reporting	Number
Soak cleaners	$8955	18
Electroless nickels	$37918	17
Electrocleaners	$8764	17
Alkaline non-cyanide zincs	$4677	16
Acid zincs and electrogalvanizing	$8183	16
Bright nickels	$13213	15
Hexavalent chromates	$7565	14
Cyanide zincs	$1609	14
Cyanides coppers	$1509	14
Acid activators	$3033	14
Parts strippers	$4629	13
General use acid coppers	$7594	12
Other PWB processes	$8863	10

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Employees and Sales

Based on responses from 47 material suppliers, they are typically not much larger than their average customer with about 39.5 employees. Their average annual sales revenues are $177-183,000/employee. Part of this relatively high value may be related to the supply of anodes and salts in high volumes via telemarketing, a low labor intensive approach. The other consideration is due to the extensive use of distributors whose sales and employee head count are not included. SFMRB estimates that distributors account for 50-60% of sales to end user customers.

Material Supplier Statistics

Year	Sales Revenue ($000)	Average No. Employees	Average Sales/supplier $000)	Average Sales/Employ	Average Cust./Suppl'r
1992	$319,000	38	$6,945	$183,000	275
1993	$340,000	41	$7,238	$177,000	308

Based on an independent study of the key industry supplier directories, it was estimated that there are about 180 different material manufacturer/supplier companies (no distributors included) serving the consumable needs of the metal finishers. Using the sales per employee ratios calculated earlier, we estimate an annual metal finishing material supplier business of approximately $1.25-1.3 billion in 1992-3.

Size of Material Supplier Business

Year	MF Sales per employee	Estimated Number of Suppliers	Total Supplier Employees	Total Sales Revenue ($bil)
1992	$183,000	180	6840	$1,250
1993	$177,000	180	7380	$1,300

Metal Salts

Only very limited information was received from manufacturers or importers of chemical salts such as nickel sulfate, copper sulfate, chromic acid, etc. For many of these materials, there are only two to four suppliers. Most of them expressed concern that contributing this information to SFMRB would weaken their competitive position. This will be an issue to hopefully resolve in future years, but for now no meaningful metal salt statistics can be reported.

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Anodes

Although there was privileged information provided on the total nickel anode market by one of the major suppliers, there was generally not enough data given to define the copper, zinc, tin, cadmium, and other anode volumes. Improving this information will be one of the key objectives for SFMRB during the next cycle.

Surface Preparation

Data was not available from a large enough fraction of the cleaner and surface preparation suppliers to enable any scaling of shop usage to total demand. A simple, historic estimate of cleaners and strippers as 30% of total proprietary chemical sales is the best the SFMRB can suggest at this time. Enhancing the information on cleaners and surface preparation material will be a focus two years out, assuming the other issues on anodes and shop usage can be solved.

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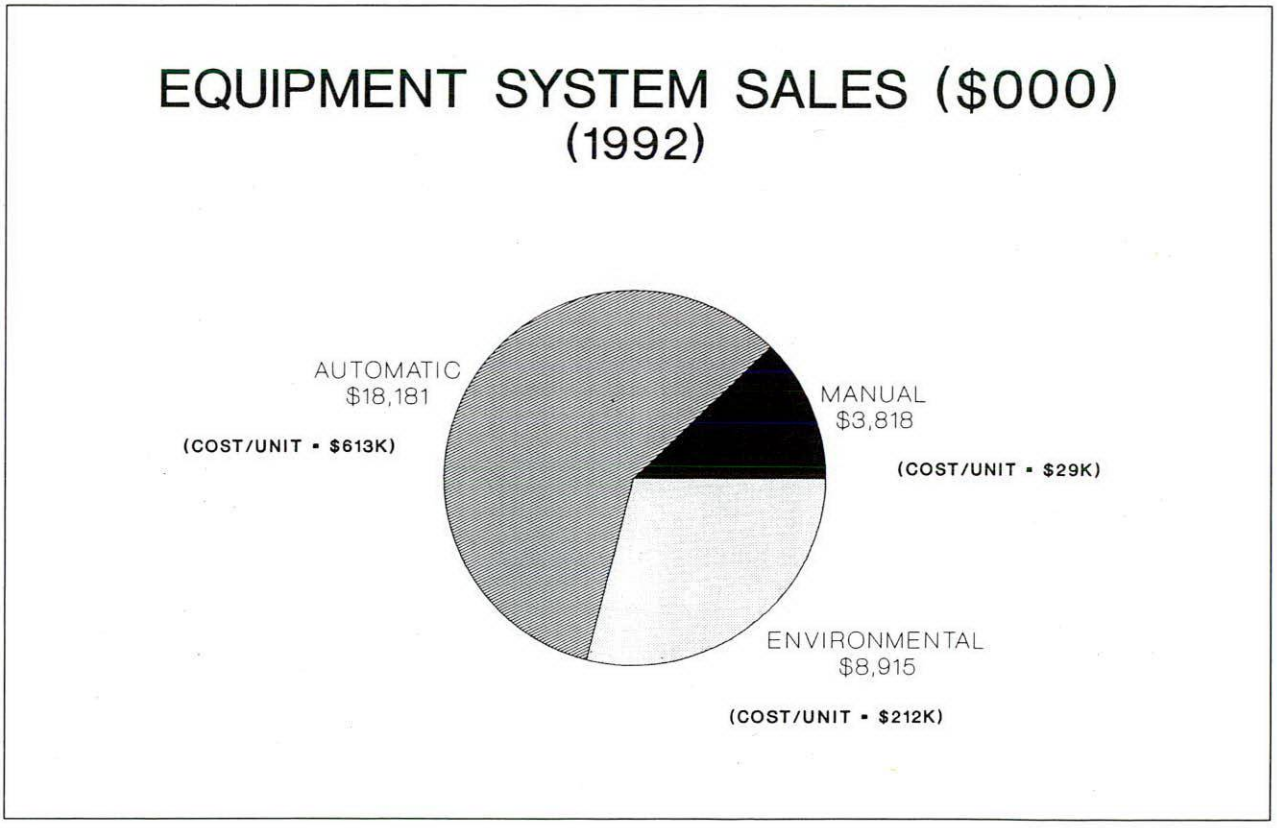
EQUIPMENT SUPPLIERS

System Sales

Seventeen supplier companies reported the following total sales of manual plating, automatic processing and wastewater treatment systems. Manual systems sold for an average of $29,000 each, automatic systems for $613,000 each and environmental systems for $212,000.

Equipment System Sales

Year	Manual ($000)	Automatic ($000)	Environ't'l ($000)
1992	$3,818	$18,181	$8,915
1993	$6,632	$18,040	$9,430



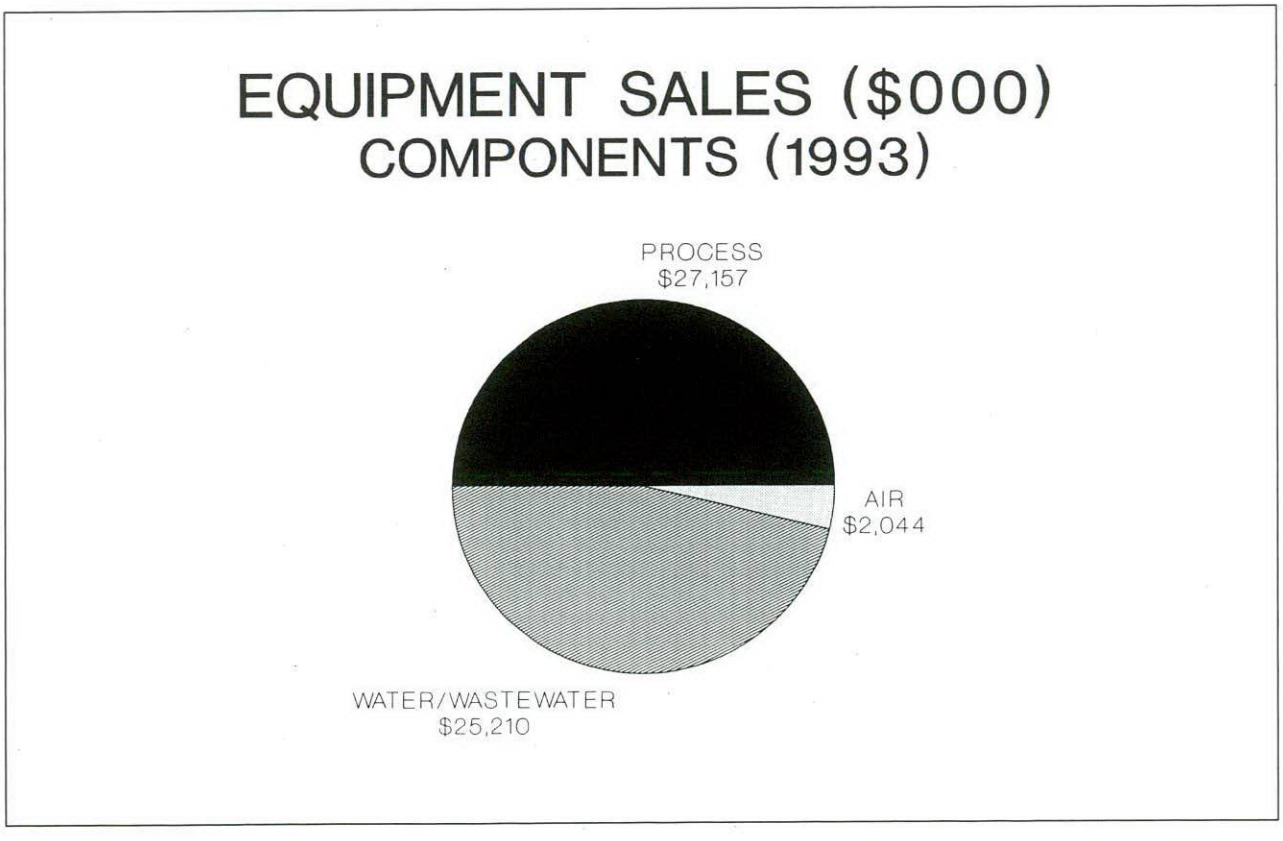
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Components Sales

Thirty-seven supplier companies reported the total sales below of process, wastewater treatment and air handling components.

Equipment Sales
(Components)

Year	Process ($000)	W & WW ($000)	Air ($000)
1992	$24,951	$21,340	$75
1993	$27,157	$25,210	$2,044



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Employment and Sales

Based on the data provided, metal finishing equipment suppliers have an average of 18.5 employees, $1,932,000 in annual sales and $104,000 in sales per employee.

Overall Equip't Supplier Statistics

Year	Metal Finishing Related Employees	Average No. Metal Finishing Employees	Average Sales/co. ($000)	Sales per Employ. ($000)	Ave. No. Metal Finishing Customers
1992	523	18.7	$1,913	$102	153
1993	515	18.4	$1,953	$106	145

From the above ratios (average number of employees and sales per employee) along with an estimate of 500 equipment suppliers (based on an independent review of industry supplier directories) the metal finishing plating related equipment business is estimated to employ 9200 people with sales of approximately $1.0 billion annually. This translates into $85,500 in annual equipment purchases per finisher or about 3.5% of the average annual job shop sales revenue.

Overall Size of Metal Finishing Equipment Business

Year	Ave Number Metal Finishing Employees	Metal Finishing Sales per Employee ($000)	Estimated Number of Suppliers	Total Supplier Employees	Total Equipment Sales Revenue ($000)
1992	18.7	$102	500	9340	$957,000
1993	18.4	$106	500	9195	$977,000

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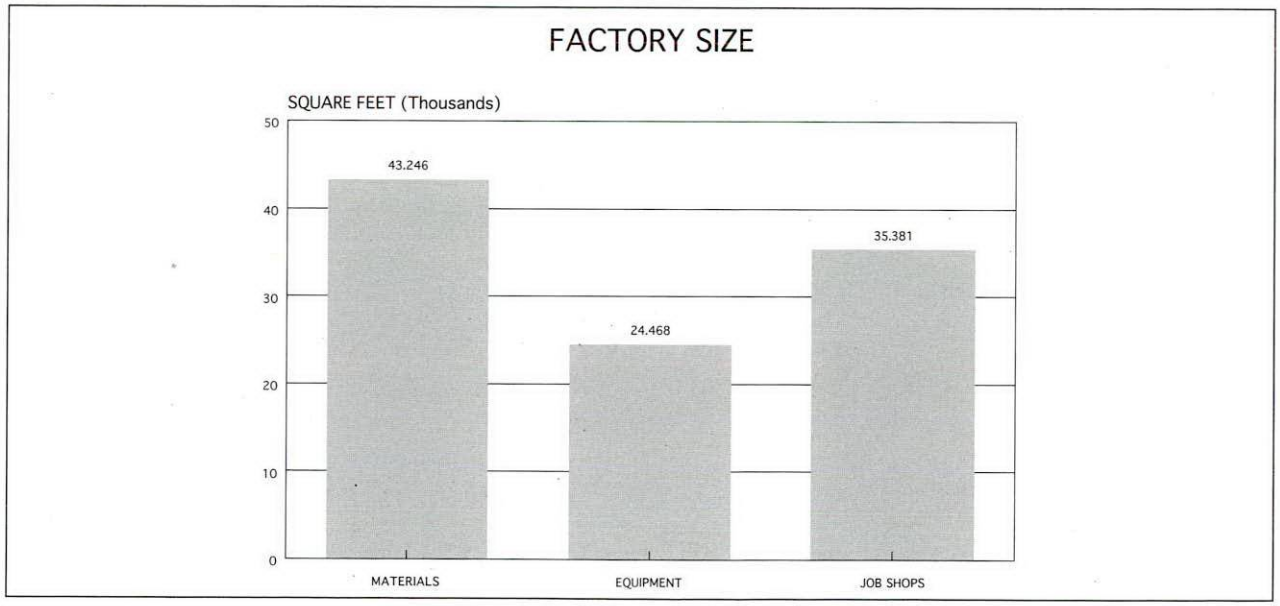
OVERALL METAL FINISHING BUSINESS

Factory Size

The relatively small size of equipment supplier facilities is speculated to reflect their large-scale reliance on sub-contractors and limited need for inventory space. Similarly, consumable material suppliers may make wide spread use of public warehouses, which would keep these numbers low.

Factory Sizes
(Average Square Feet)

Materials Suppliers	43,246
Job Shop Platers	35,381
Equipment Suppliers	24,468

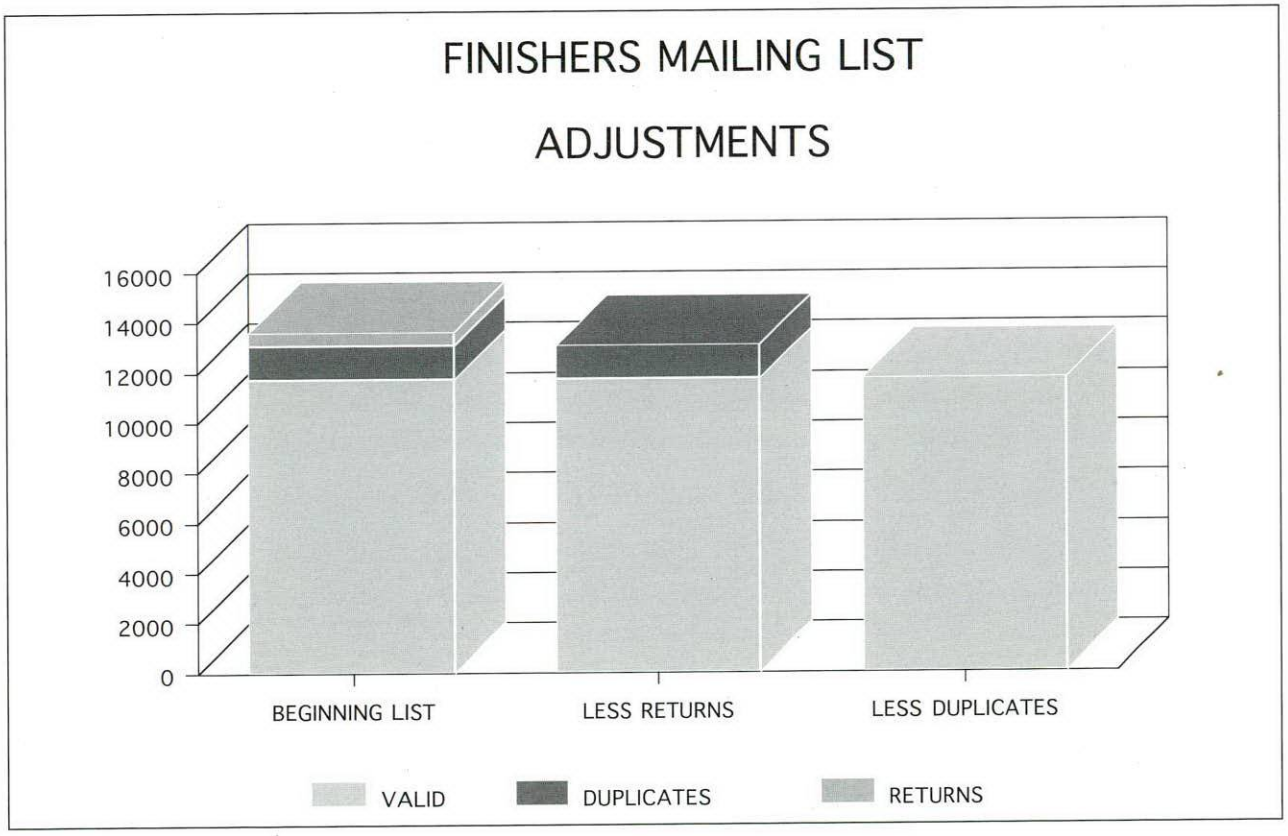


The Metal Finishing Universe

The first estimate of the total number of the U.S. and Canadian metal finishers came from the merged mailing list provided to the SFMRB. The 10% allowance for duplicates, duds, etc. comes from a one-time perusal of the list looking for obvious consultants, distributors, associations, government agencies, etc. There were returns of SFMRB questionnaires sent back saying that no metal finishing activity was taking place. These numbers should include coil coaters, anodizers, polishers, vacuum coaters, etc. Although there is considerable sentiment among the SFMRB that this universe is too large, there is no objective basis on which to scale back further.

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Universe of Metal Finishers (Estimated from mailing list)	
Merged mailing list	13621
Less allowance for duplicates (10%)	(1362)
Merged less duplicates	12259
Less returns (4.5%)	(552)
Total Number of Finishers-Estimate	**11,707**



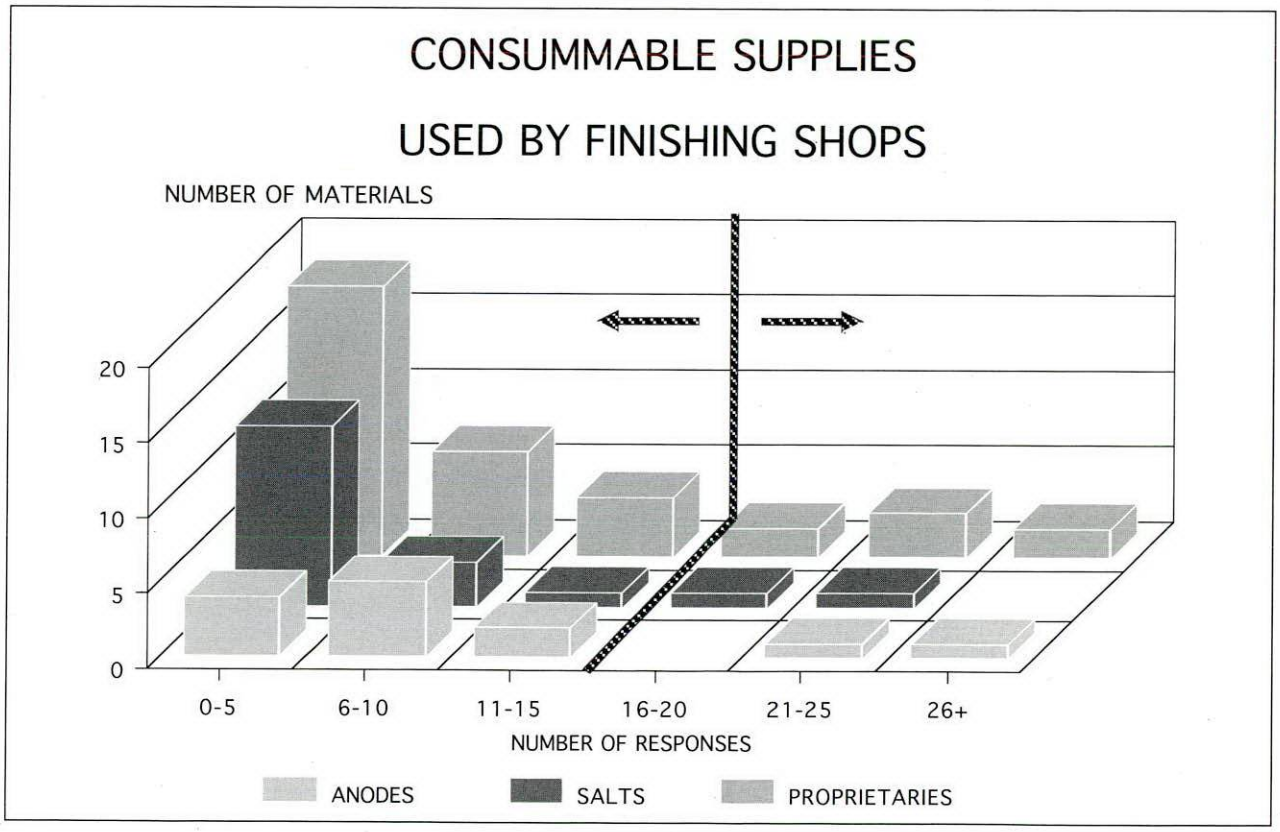
Data Available

If meaningful statistical analysis requires at least 25 respondents, then this was only achieved in three categories, as illustrated in the next table. If we bend this "meaningful" rule to include 16 or more responses, then seven proprietary chemical materials, two metal salts and two anodes qualify. These were used to develop the total universe of plating shop statistics. The metal salts data were set aside per the above discussion.

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Consumable Supplies
(Reported by Finishing Shops)

Number of Facilities Reporting	Proprietary Chemicals	Salts	Anodes
0 to 5	18	12	4
6 to 10	7	3	5
11 to 15	4	1	2
16 to 20	2	1	0
21 to 25	3	1	1
26+	2	0	1
Total Processes Reported	**36**	**18**	**13**



Clearly the processing data reported in the survey is an area with disappointing results. Different approaches are being considered by the SFMRB for next year's efforts to improve the available data . All the new approaches eliminate the current long questionnaire, which received some criticism.

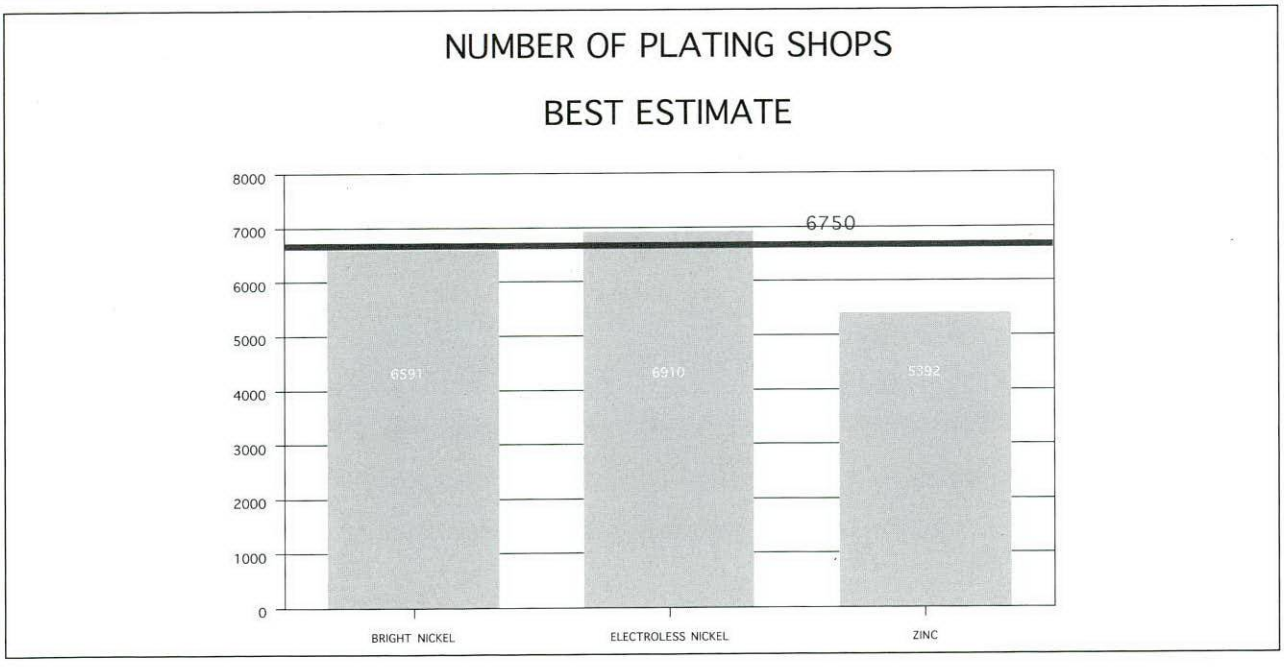
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Number of Plating Shops

The total number of U.S./Canadian plating shops (the universe) is likely to be close to 6750 as calculated from three independent process bases. The estimate based on zinc is the least confident based on fewer data points being available. These estimates were scaled off the materials cost/tank data from the reporting shops, fraction of shops using this process, number of tanks/shop, and total size of consumable sales in that area. Obviously, not every supplier reported their consumable sales. An estimate was made of the fraction of large and medium size vendors reporting. This was used to scale up the statistics to total consumable sales. These statistics were then submitted to MFSA's CPA who indicated the degree of agreement with MFSA's own internal indices. In all cases, agreement was acceptably close and no further adjustments were made. Typically, two-thirds of large and medium consumable material vendors fully supported SFMRB by providing data. The only exception was in the precious metal material supplier area, which was much lower.

Plating Facility Estimates
(Shops Doing Plating)

	Total Estimated Number of Shops
Based on Bright Nickel Plating Analysis:	**6591**
Based on Electroless Nickel Plating Analysis:	**6910**
Based on Zinc Plating(Acid, CN, & Alk.) Analysis:	**5392**



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IPC

Courtesy of SFMRB's mentoring organization, the IPC's T/MRC, we have the following statistics related to bare board production in the U.S. and Canada. The sales values include laminate, drilling, photo-imaging, etc. as well as plating. Developing, in conjunction with IPC, a factor to apply to this total that represents wet processing will be a future activity for the SFMRB.

PCBs

Category	No. Facilities	Revenues ($000,000)
Independents	750	$3,378
Captives	20	$1,538
Totals	770	**$4,916**

Size of Metal Finishing Business

In summary, it is estimated that the metal finishing industry of North America involves more than 12,000 companies with nearly 520,000 employees. This assumes 42.3 employees per finisher and a 50/50 ratio of job shops to captives. The estimated GDP contribution from the metal finishing industry segment is nearly $47 billion or around 1% of the annual U.S total.

The "other finishing" category, in the next table, is an educated estimate and was not part of the detailed analysis conducted for the plating segment. It was assumed that they had the same sales/employee ($82,500) and employee/company (42.3) ratios as the plating finishers. The other finisher statistics includes such operations as painting, powder coating, phosphating, coil coating, polishers and vacuum coaters.

The final estimated 180 proprietary material manufacturer/suppliers below, is much lower than the 1425 on the initial mailing list, as it was determined that the initial list contained many distributors and resellers. These were not included in the final numbers to eliminate duplication.

The other material supplier estimates were based on the finishers' expenditure of 14% of revenue on all materials. These suppliers were not analyzed in this study.

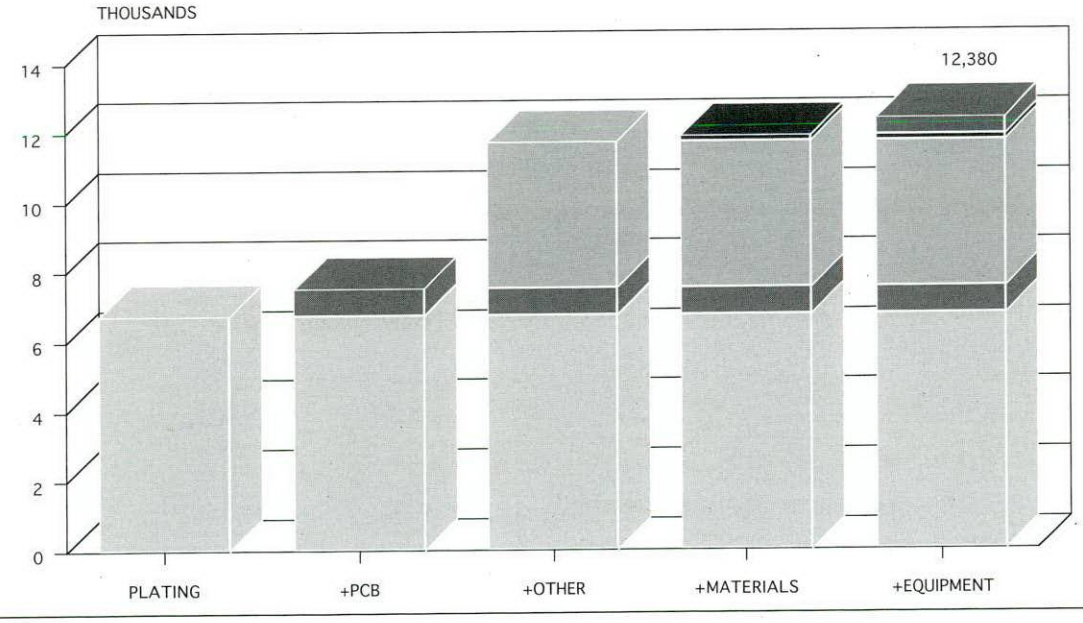
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Employee and GDP Impact of Metal Finishing Business

Category	Number of Companies	Number of Employees	Sales per Employee	GDP Contribution ($000,000,000)
Job Shops and Captives				
•Plating	6750	285,500	$82,500	$23.6
•PCB	770	40,000	$122,300	$4.9
•Other Finishing	4180	176,800	$82,500	$14.6
Finishing Materials	180	7100	$180,000	$1.3
Other Materials	?	?	?	$1.4
Equipment Suppliers	500	9200	$114,000	$1.0
TOTALS	**12,380**	**518,600**		**$46.8**

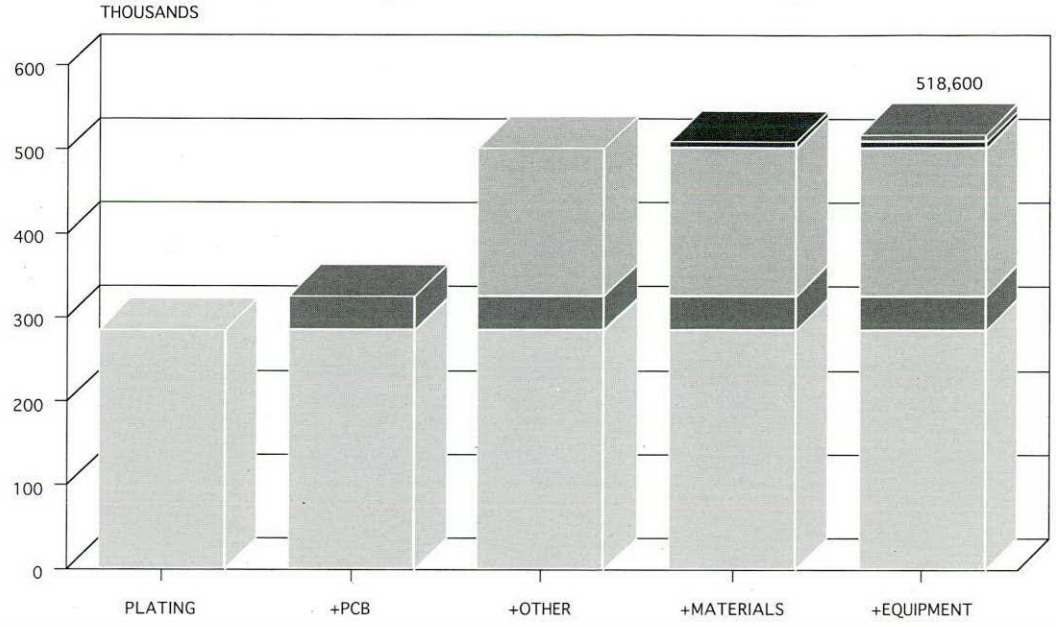
NORTH AMERICA

NUMBER OF FINISHING FIRMS

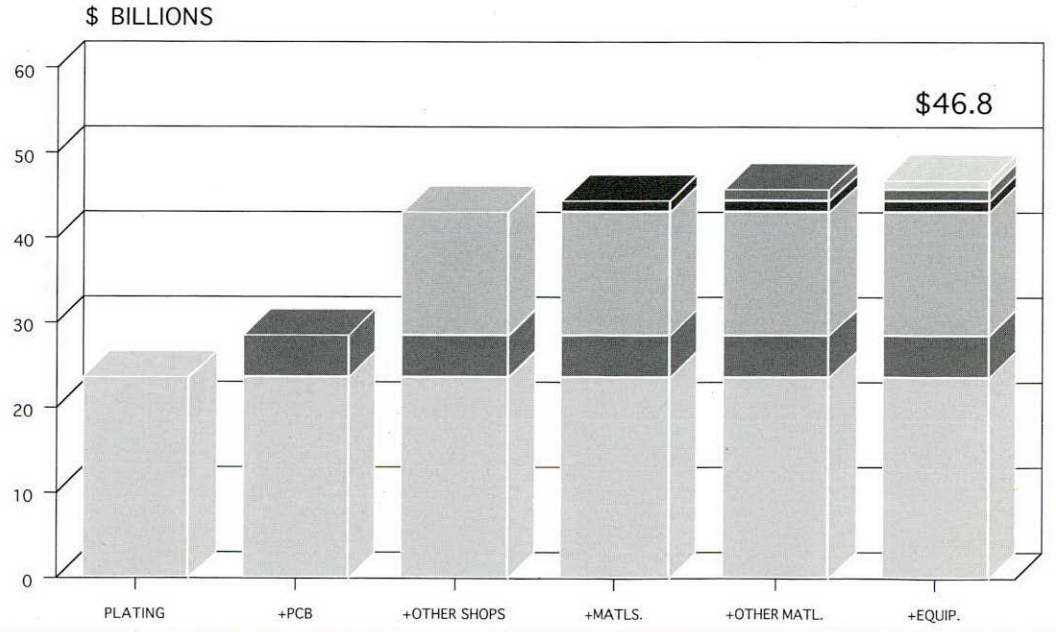


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NORTH AMERICA
NUMBER OF FINISHING EMPLOYEES



NORTH AMERICAN FINISHING
GDP CONTRIBUTION ($ BILLIONS)



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Future

In future years, the SFMRB will work with the non-responding firms to encourage more cooperation.

Verification of the finishing shop list by direct contact, such as phone follow-up would be prohibitive. SFMRB's current budget is $35,000/ year and should be expanded with additional participation; but is, and will be, a bargain to the industry.

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Al Coppola	Enthone-OMI
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Duff Gerhardt	General Super Plating
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Brad Parcells	NAMF
Jerry Poll	Products Finishing Magazine
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MOVING FORWARD TOGETHER

SFMRB

Surface Finishing Market Research Board

mfsa

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MOVING FORWARD TOGETHER

SFMRB

Surface Finishing Market Research Board

SFMRB
METAL FINISHING
INDUSTRY
MARKET SURVEY

1992-1993

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EXECUTIVE SUMMARY

For some time there has been a need to statistically define the current size and status of the metal finishing industry in North America. It was agreed by both suppliers and job shop metal finishers that this would help most of those involved in the industry with their financial and congressional credibility as well as for their own planning efforts. To this end, the SFMRB was formed early in 1993 by members of NAMF, MFSA and their invited guests, under the guidance of IPC.

The SFMRB, with the cooperation of all the key associations and trade journals, created a comprehensive, merged mailing list of 13,600 metal finishers and 1950 metal finishing suppliers. Four different, customized survey forms were designed by the committee to obtain information from job shop finishers, captive finishers, consumable material suppliers and equipment suppliers. The forms were mailed to a majority of the mailing list in September, 1993. A system to maintain confidentiality of all information was designed using a CPA firm. By the end of 1993, 276 usable completed survey forms were received and analysis began.

Statistically significant reported data was used to calculate scaled-up industry results using three different statistics as a cross check. The key findings of the analysis of the survey data, related only to the metal finishing industry, are:

° The total metal finishing industry is estimated to employ nearly 520,000 people with an annual GDP contribution of nearly $47 billion, 1% of the U.S. total.

° Three-quarters of the metal finishing industry believes business will improve in 1994; 15% think it will be worse and 10% that it will remain unchanged from 1992-3.

° Average factory sizes are 24,000 square feet for equipment suppliers, 35,000 for job shop finishers and 43,000 for consumable material suppliers.

° Job shop metal finishers average 34.5 employees; captives 50; material suppliers 39.5 and equipment suppliers 18.5.

° The average job shop has $2.5 million in annual sales revenue; the average material supplier $7 million and the average equipment supplier $1.9 million.

° Job shop metal finishers average sales per employee are $75-88,000; material suppliers $177-183,000 and equipment suppliers $102-106,000.

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° The average metal finishing facility plates approximately 2 million square feet per year. Mild steel is the dominant substrate with 59% followed by copper alloys (14%), hard steel (9%) aluminum (7%) and plastics(6%). Zinc diecasting is believed to be under-represented.

° There is an average of 2.2 plating lines per facility, with 66% manual. Thirty-seven percent are barrel, 31% rack and the balance use both.

° In North America it is estimated that there are 6750 plating facilities (captive and job shop), employing 285,000 people with an annual gross domestic product contribution of $23.6 billion.

° The automotive market segment demand dominates with a 40% share of all finishers' business, followed by consumer durables and electronics each with approximately 10%. Electronics is believed to be under-represented.

° Job shop reported costs are:

-Labor, 28%

-Material, 14%

-Environmental, 5%

-Safety and Health, 2.5%

° An estimate for the 4180 other finishers, including anodizers, buffers, antiquers, polishers, etc., is that they employ 176,000 people with a gross domestic product contribution of $14.6 billion.

° The 680 metal finishing proprietary material and equipment suppliers are estimated to employ 16,000 people with a gross domestic product contribution of $2.3 billion.

° Material suppliers each serve about 275 customers annually while each equipment supplier serves approximately 150.

° The average finisher spends $85,000 annually on equipment or 3.5% of annual revenue.

In future years, a broader cooperation from all segments of the metal finishing industry will be encouraged, to enable the SFMRB to report improved, more comprehensive and more accurate data on the industry.

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STATUS OF THE INDUSTRY

In the last two decades the metal finishing industry in North America has been groping for direction, buffeted by the winds of economic, technical, and environmental change, and has lacked a clear idea of exactly where it is.

The most difficult, yet most important, job of a navigator is to learn where he or she stands. An industry in transition finds the task of managing its changes infinitely harder if basic statistical information is lacking. How do you set a course, when you don't know where you are?

Lacking basic statistics on your industry, how do you convince your bank to lend money for investments in more productive plant and equipment? How do you tell your Congressional representatives the number of jobs affected by pending legislation, and the contribution made to the GDP by the industry? Where can you obtain information on new markets and growth areas? The Surface Finishing Market Research Board (SFMRB) was created to help answer these questions.

The concept for the SFMRB was first conceived in April of 1991 within the Metal Finishing Supplier's Association (MFSA). On January 8th, 1993 a meeting was called by MFSA, with representatives of the American Electroplaters and Surface Finishers Society (AESF), the Institute for Interconnecting and Packaging Electronic Circuits (IPC), and the National Association of Metal Finishers (NAMF) invited to attend. The purpose of the meeting was to establish a plan of action for the SFMRB, modeled after the Technical/Marketing Research Committee (T/MRC) of IPC.

The meeting was hosted by IPC at its headquarters in Lincolnwood, Illinois. The objective would be to obtain information relating to the size of the market for surface finishing, including sales of equipment and materials, sales and markets for finishing services, and employment within the finishing industry. One of the first considerations was to decide how best to get meaningful statistics, and how to fund the effort. A number of proposals were discussed.

At their respective meetings in January and February of 1993,the boards of MFSA, NAMF and AESF were presented with a request for funding, based on the use of survey forms. NAMF and MFSA subsequently approved the requests and formally announced the formation of the SFMRB. Jointly funded by the two organizations, the mission of the SFMRB was defined to undertake a two-year effort to develop and refine a detailed information base about the current status and

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future trends of the surface finishing industry. It was anticipated that the information developed would help both metal finishers and their suppliers make better decisions regarding areas for business development, as well as provide the industry with more detailed information regarding employment and industry activity for use in presentation to governmental and regulatory bodies.

The results of the first year of the project are being presented at the inaugural joint convention of the American Society of Electroplated Plastics (ASEP), NAMF, and MFSA to be held at Hilton Head, South Carolina in March, 1994.

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METHODOLOGY

A steering committee composed of representatives from the NAMF and MFSA, along with invited guests, met in June of 1993 in Anaheim, during the AESF SurFin® conference to discuss details for implementation of the plans approved by the respective boards. Mr. Howard Smith of Atotech USA was designated as committee chairman. It was established that a series of four mail surveys would be conducted with questionnaires designed to permit scale-up of the data and cross checking between users and suppliers. The four survey groups to be included were job shop finishers, captive finishing shops, equipment vendors, and material suppliers. Copies of the forms used are available from MFSA headquarters.

All data received would be treated as confidential. Individual companies would return completed forms to a CPA, who would then remove all identifying information and code each response. Participants would be entitled to a summary of the results and for this purpose the CPA would retain a listing and also endeavor to eliminate duplicate forms insofar as possible.

The purpose of the questionnaires was to provide information that would determine the size of the industry in terms of number of installations where finishing is performed, the number of employees at these locations, consumption of chemicals, sales value, and related data. Technology and market trends, costs for pollution control, etc. would also be explored.

In order to obtain the most complete listing possible, the related trade associations and major trade publications were asked to participate by contributing the use of their mailing lists. *Metal Finishing , Products Finishing and Finishers Management* agreed to supply their lists, as did AESF and ASEP. The lists were supplied to a bonded mailing house along with those of NAMF, AESP and MFSA. Duplicate entries were eliminated where possible. Mailings were then made in the fall of 1993 to a broad selection of the merged listings in the four categories.

Respondents in the U.S.A. and Canada were asked to supply information related to electroplating, etching, anodizing, printed circuit board fabrication, connector and semiconductor manufacturing; but not painting, powder coating, phosphating, coil coating, and vacuum coating operations.

Job shops and suppliers were asked to supply sales data for 1992 and the first half of 1993. All respondents were asked about employment related to metal finishing.

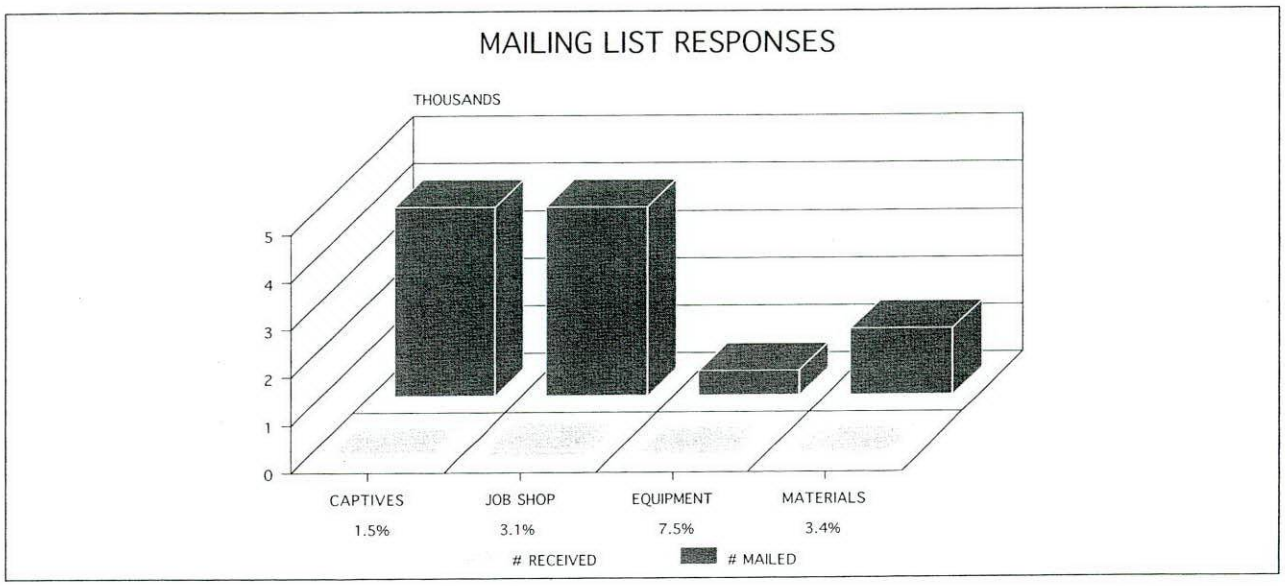
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The user surveys requested data on processes and equipment, while the suppliers were asked to provide details on sales of equipment, chemicals and materials in various categories.

The basic assumption behind the planned use of these statistics was to have a three-way cross check. If at least 25 shops submitted user statistics for any single process, one could assume a meaningful average was obtained based on a normal distribution of results. If the universe (i.e., total industry use) of proprietary chemicals, chemical salts, or anodes is known, then it should be possible to scale up to the total industry activity for that process. If all three scaling factors are known, up to three estimates of the industry totals are possible. This logic implied the need for the SFMRB to achieve nearly complete cooperation of the consumable suppliers and broad response from shops using the various processes.

Completed questionnaires were mailed by the respondents to S.R. Snodgrass & Co., Certified Public Accountants, of Mentor, Ohio. The firm numbered each response, and removed the section giving company name, and address to maintain confidentiality. Numbered forms were submitted to the consultant, David Lucas, D. K. Lucas & Associates of Jensen Beach, Florida for analysis and preparation of a report.

The following table gives details on the size of the merged mailing list (total list) for each category, the number of questionnaires mailed, the total number of responses, and the number of usable responses for each of the four categories. A usable response was simply one that contained sufficient information to be worthy of tallying.



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Mailing List/Responses

Category	Total List	Total Mailed	Responses	Usable Responses	Usable % of Total Mailing
Captives	7212	4000	297	59	1.5%
Job Shops	6409	4000	295	123	3.1%
Equipment Suppliers	541	541	71*	41	7.5%
Material Suppliers	1425	1425	291*	53	3.4%

(* Includes distributors who should not have responded)

Follow up mailings and phone calls were conducted to improve the volume of usable responses, which ranged from 1.5 to 7.5 percent. Typical industry responses to mail surveys of this type range from 1.5 to 6 percent, so the results were within the acceptable range, although the captive shops were at the low end of the range. During analysis of the data it was noted that responses from printed circuit fabricators were also low.

Databases were established on a personal computer and the data screened for consistency and completeness. Since there was a relatively small response from Canada, it was decided to treat data submitted in Canadian dollars as equivalent to U.S. dollars. There was some discrepancy noted in the reporting of 1993 first half sales, as some respondents obviously inserted full year values. These were adjusted, taking into consideration other information provided, such as trends, projections, and employment levels.

Considering the quality and quantity of the responses, SFMRB believes the values reported to be plus or minus 10-20 percent of reality.

Additional information, collected during the survey, but not included in the report, has been retained and may be available from MFSA or NAMF.

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PLANT LOCATIONS

Each of the four surveys requested that respondents include a zip code so that information could be provided as to the location of plant sites. The table below summarizes the percentage of plant sites for captive and job shop finishers and for the suppliers in eight geographical regions in the U.S. and Canada.

Nearly 42% of the responding plating shops and suppliers are located in the central region, Ohio to Missouri, Indiana to Wisconsin. The Atlantic Coast, which is from Pennsylvania and New Jersey through the Carolinas are next with about 25%. New England and the Pacific Coast areas were third with 10-12%. In general, job shops responded with usable data more than did captive shops. Supplier locations tended to roughly follow the same pattern, with the exceptions of the Pacific Coast, which was lower, and New England, which was especially higher.

Locations of Responders

Geographic Area	Captive and Job Shops	Suppliers
New England	7.8%	13.0%
Mid Atlantic	15.5%	19.8%
Southeast	5.5%	13.2%
East Central	26.1%	23.6%
West Central	16.7%	15.1%
Southwest	3.9%	0.9%
Mountain	2.8%	2.8%
Pacific Coast	15.0%	5.7%
Canada	6.7%	5.7%

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BUSINESS TRENDS

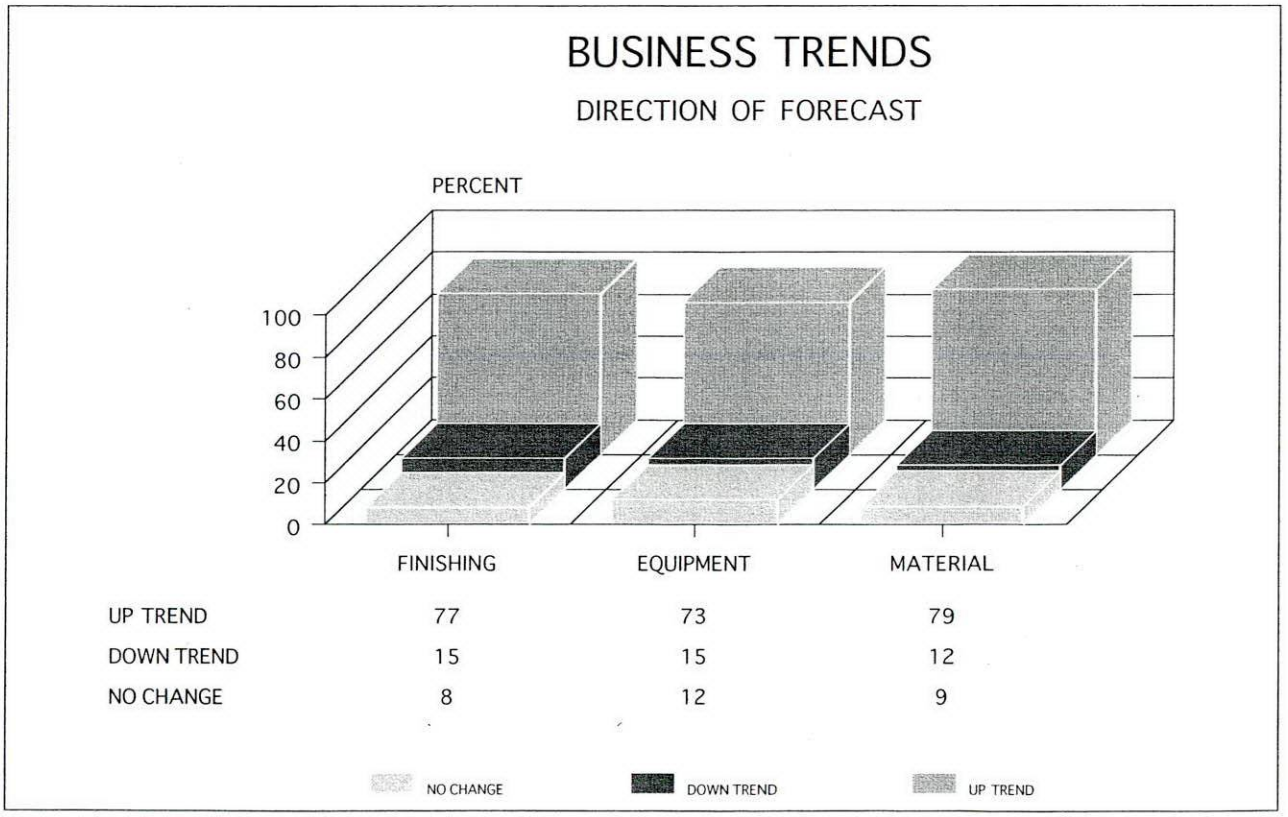
The general and categorical trends, summarized in the tables below, are based on responses from 172 job and captive shops, 52 material suppliers and 40 equipment suppliers.

Three quarters of all respondents forecasted an upturn in business and only 12-15% expect a downturn in 1994. The balance forecasted no change.

Business Trends
(Direction of Forecasts)

	Finishing	Equipment	Material
Business Up	77%	73%	79%
Business Down	15%	15%	12%
Business Unchanged	8%	12%	9%

The finishing shops, who forecasted an increase in 1994 business, averaged 30% up. Those forecasting a decrease averaged 27% down. The supplier-forecasted increases and decreases were a less radical 18% up and 14% down.

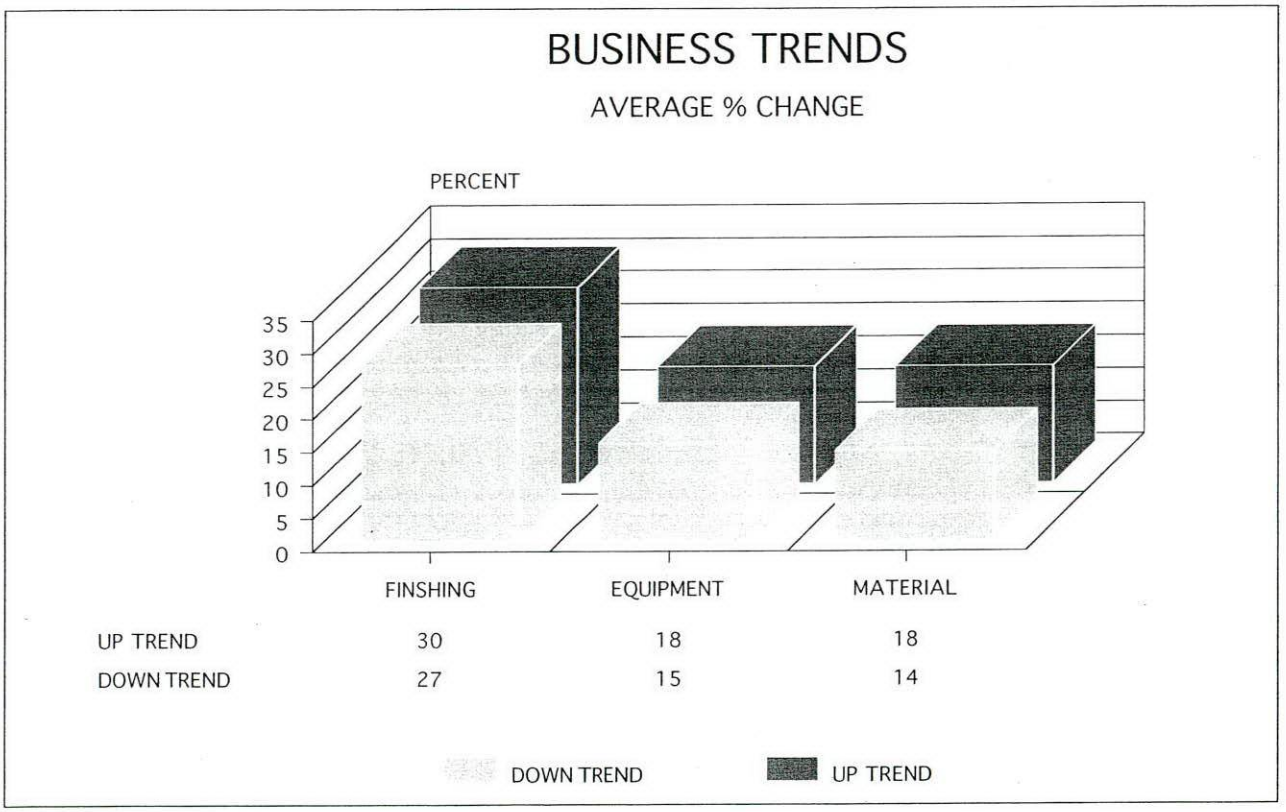


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Business Trends
(Ave.% Change)

	Finishing Shops	Equipment Suppliers	Material Suppliers
Business Up	30%	18%	18%
Business Down	27%	15%	14%

Finishing shops most frequently anticipate their business growth to come by taking business from their U.S. and Canadian competitors and from the general upswing of the economy. Captive shops out-sourcing was also mentioned by almost a third of all respondents.



Equipment suppliers most mentioned an upward impact from Mexico. They were the only group to think NAFTA will have an effect soon. U.S./Canadian competition and improving economic conditions were almost as important to the equipment companies.

Consumable material suppliers mainly expect increases in their business to come from their U.S. and Canadian competitors. Second in mentions (of 25-33% each) was overall economic growth, Mexico (despite NAFTA) and out-sourcing.

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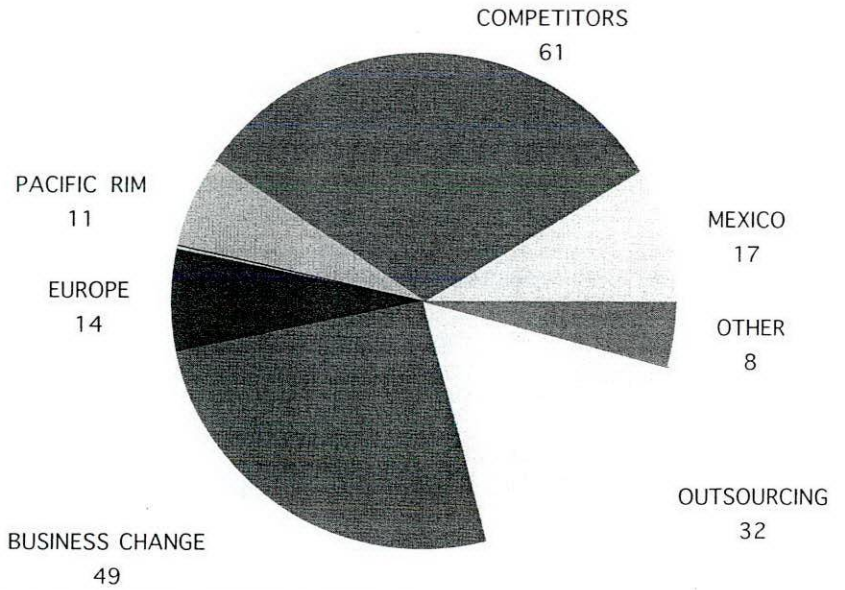
Increasing Business (Categories)

Source of Increase	Finishing Shops	Equipment Suppliers	Material Suppliers
Mexico	17%	43%	28%
U.S./Can. Competitors	61%	38%	63%
Pacific Rim	11%	8%	25%
Europe	14%	15%	12%
Change in Bus. Cond.	49%	35%	33%
Out-sourcing	32%	3%	20%
Other	8%	13%	29%

(Multiple responses from some respondents gave values in this table exceeding 100%)

INCREASING BUSINESS

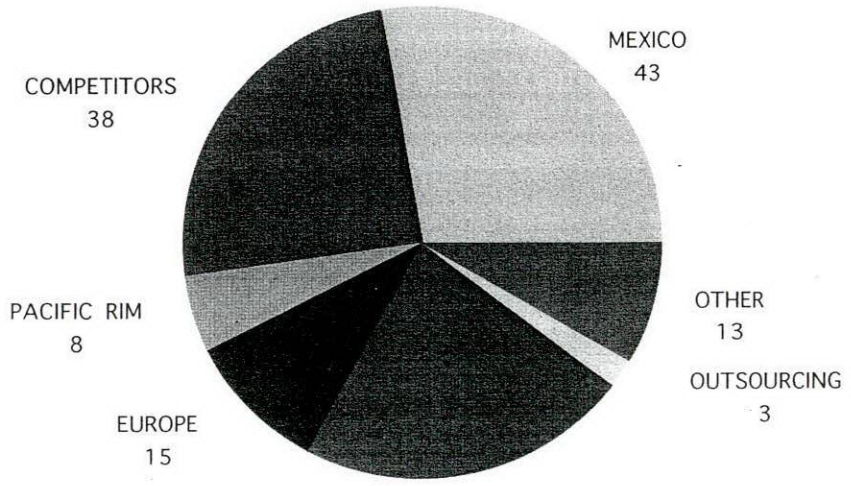
FINISHING SHOPS (%)



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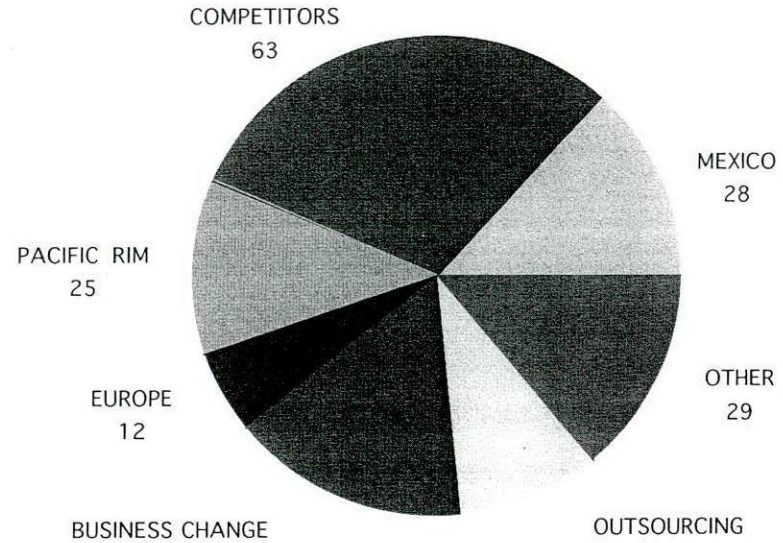
INCREASING BUSINESS

EQUIPMENT SUPPLIERS (%)



INCREASING BUSINESS

MATERIAL SUPPLIERS (%)



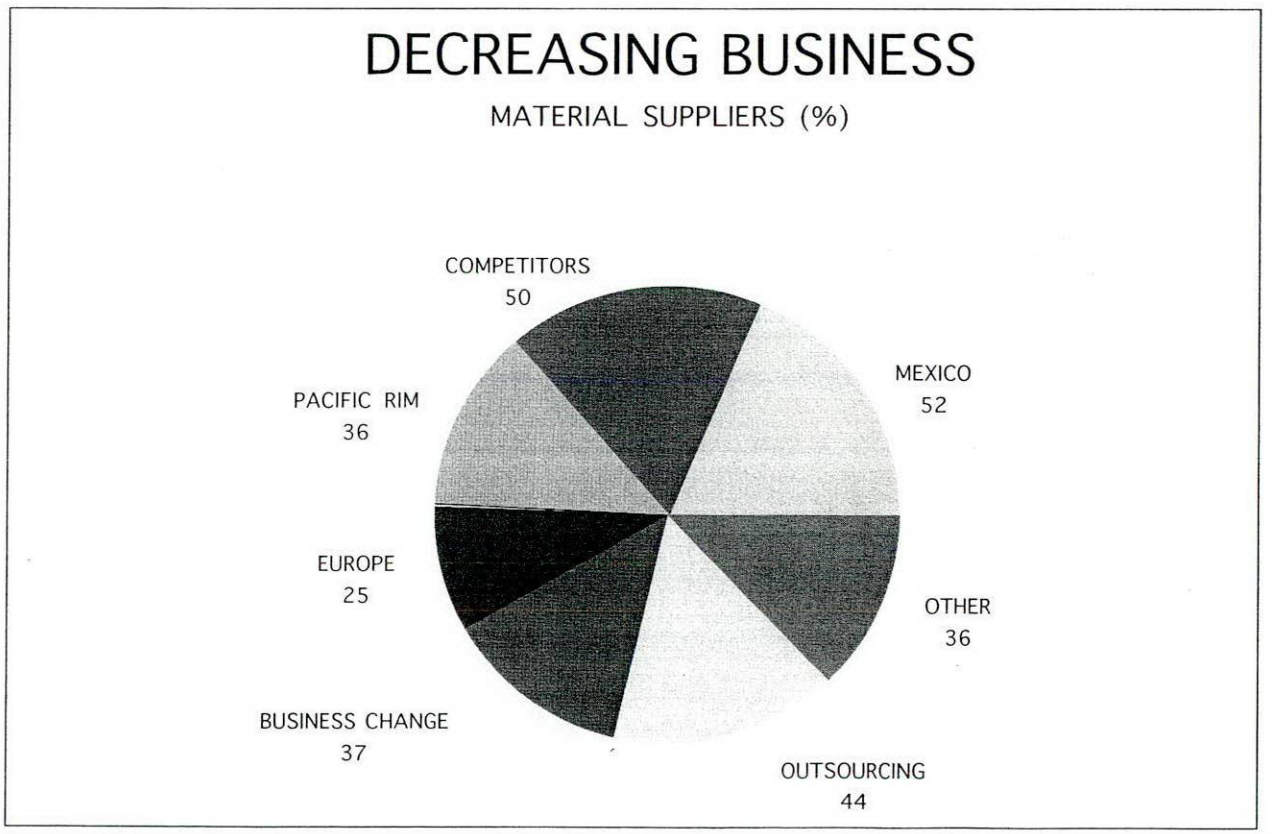
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Decreased finisher business forecasts seemed predominantly driven by expected changes in business conditions due to sector shrinkage. The government, aerospace and electronics sectors were mentioned most. About equally mentioned as a business shrinkage reason was competition from U.S./Canada and from Mexico. Surprisingly, the Pacific Rim seemed of less concern than Europe as a factor for either growth or shrinkage.

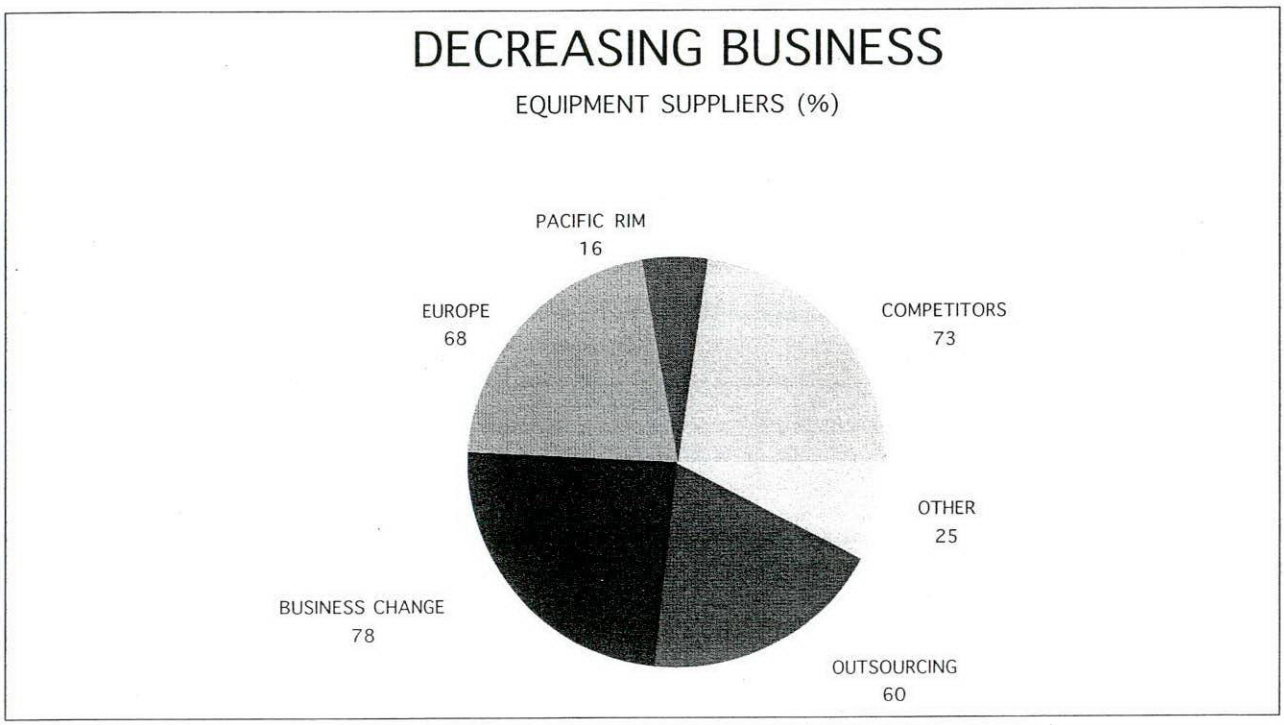
Decreasing Business Categories

Source of Decrease	Finishing Shops	Equipment Suppliers	Material Suppliers
Mexico	42%	0%	52%
U.S./Can. Competitors	42%	73%	50%
Pacific Rim	15%	16%	36%
Europe	19%	68%	25%
Change in Bus. Cond.	81%	78%	37%
Out-Sourcing	19%	60%	44%
Other	8%	25%	36%

(Multiple responses from some respondents gave values in this table exceeding 100%)

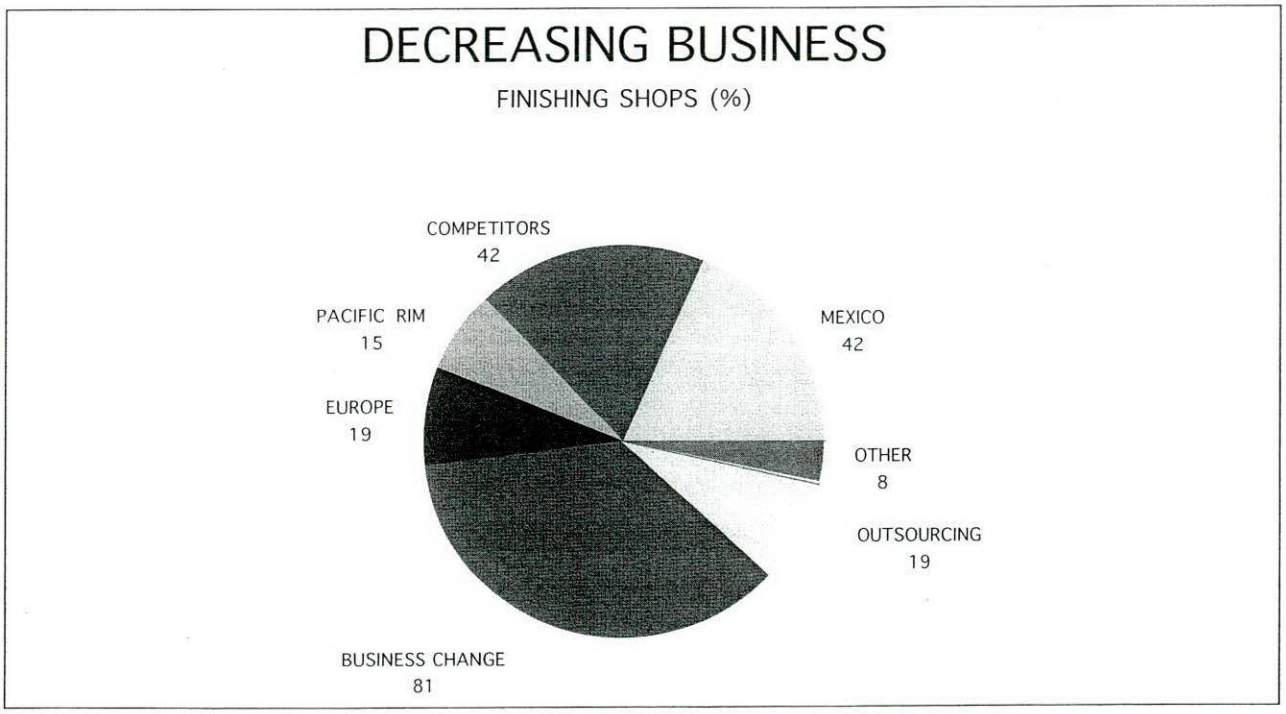


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For equipment suppliers, the most commonly mentioned areas for downturn were, as with finishers, sector shrinkage, North American competitors, European competitors and out-sourcing by captives.

The main downward business pressures reported by consumable material suppliers were effects from Mexico, their U.S./Canadian competition and fears of direct competition from out-sourcing by captives.



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JOB AND CAPTIVE SHOPS

Employment and Sales

Useful responses were received from 123 job shops. However, since some of the useful questionnaire responses were not complete, the employee statistics summarized below cover only those shops providing both employee and total sales data. The growth in employment is consistent with the general optimism about the 1994 economy. Averaging the 1992 and 1993 responses, the typical job shop produces an annual average revenue of $82,500/ employee. (NOTE: The 1993 numbers in this report have not been adjusted for inflation.)

Job Shop Employee Statistics

Year	No. Job Shops	Total Employees	Avg. Employees per Job Shop	Avg. Sales per Employee
1992	117	3717	32	$76,300
1993	117	4280	37	$88,700

Useful responses were received from 59 captive shops. The table below gives an indication of the averages and medians relative to the employment levels by all finishing shop respondents.

Surprisingly the 80/20 rule does not seem to apply to finishing shop size or employment, based on the 1992 reported data. Small shops are more numerous than one might expect from an industry that is mature, transportation radius sensitive and not highly differentiated. The median value is the point where 50% of the responses are above and 50% are below that value. The average job shop had 32 employees in contrast to captive shops which averaged 50.

Employment in Metal Finishing Shops
(1992)

	Job Shops	Captive Shops
Number reporting	117	54
Total MF Employees	3717	2687
Average	32	50
Median	17	15

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Sales volume for job shops is summarized below. Captive shop sales were not requested as it was felt that the information could be misleading. These average sales/shop levels with the above average employees/shop and the average sales/employee ratios proved to be very useful in our later scale-up analyses.

Sales Volume for Job Shops (1992)

Total Sales	$283,546,000
Average	$2,466,000
Median	1,108,000

Based on 115-117 useful responses and an equal weighting to sales and employees, the responding job shop finishers were ranked into 5 equal percentile groups (highest to lowest). This analysis indicates that a majority of the respondents to the survey were below the averages and medians mentioned above. Also, the data indicates that the 80/20 rule does not apply in that the top 20% of respondees only account for 65% of sales and employees. This is typical of a mature job shop industry. However, the 80/20 rule is closer to the data reported for captive finishers.

Size of Finishing Shops

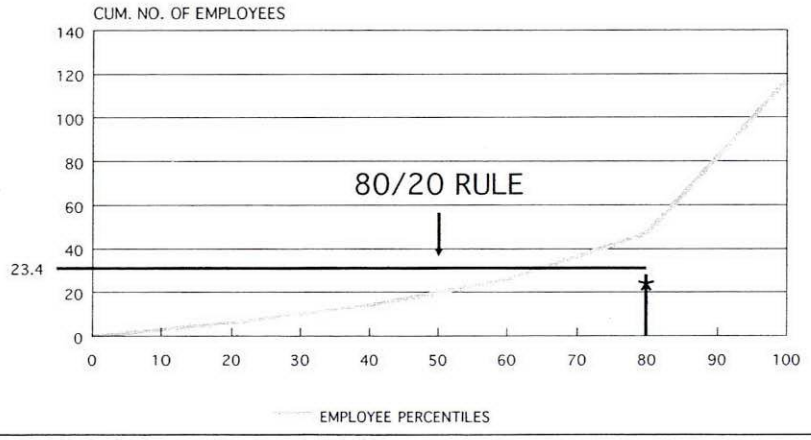
Percentile	No. Job Shops (by Sales)	No. Job Shops (by Total Employees)	No. Captive Shops (by Metal Finishing Employees
20%	2	6	1
40%	6	8	3
60%	11	12	2
80%	20	21	6
100%	76	70	42
Totals	**115**	**117**	**54**

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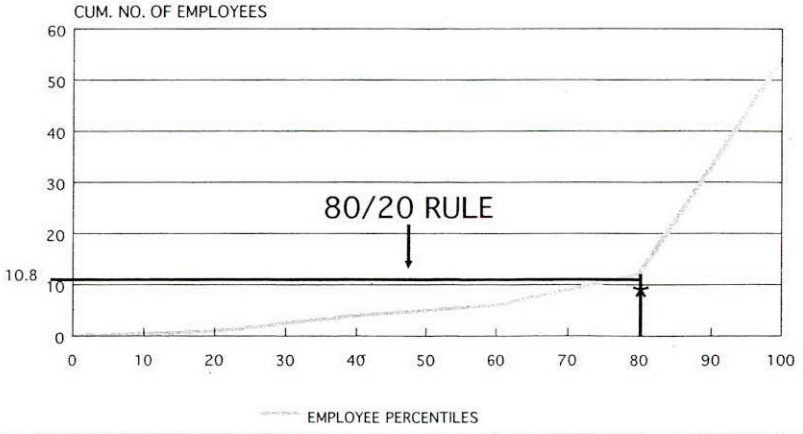
SIZE OF JOB SHOPS
SALES DISTRIBUTION IN PERCENTILES



SIZE OF JOB SHOPS
TOTAL EMPLOYEES IN PERCENTILES



SIZE OF CAPTIVE SHOPS
TOTAL EMPLOYEES IN PERCENTILES



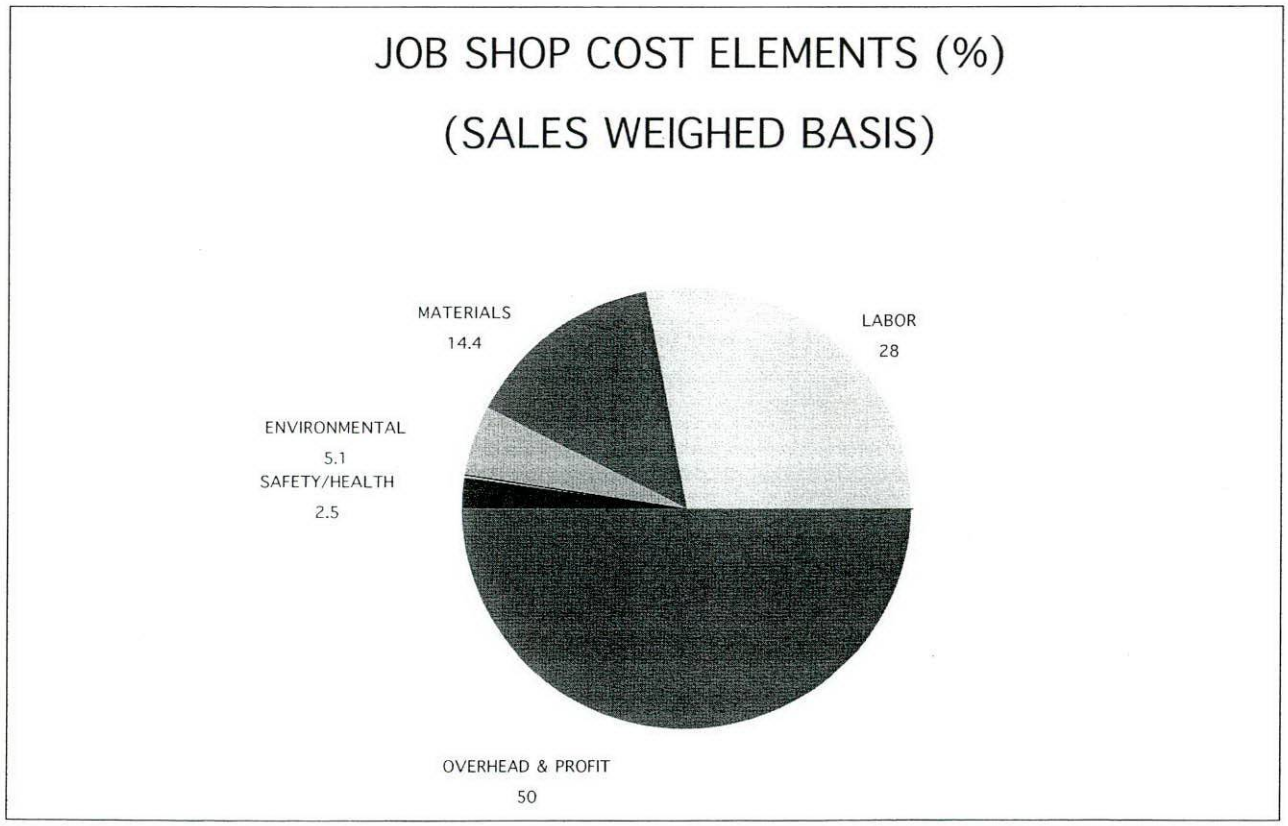
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Job Shop Costs

Based on both the average response, and the sales-weighted average response, job shops reported typical direct labor costs of 25-28%, direct material costs of 13-14%, environmental costs of about 5% and OSHA/Safety costs of slightly less than 3%. For many shops the 8% total compliance area cost, is likely more than their pre-tax profits. (SFMRB speculation)

Job Shop Costs
(1992)

	Labor	Material	Environmental	Safety Health
Total Responses	164	162	161	150
Average %	25.3%	13.3%	5.1%	2.6%
Sales Weighted Average %	28.0%	14.4%	5.1%	2.5%



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Markets Served

The three dominant markets are automotive, consumer durables and electronics. Automotive, medical and recreational are all expected to improve with the domestic economy upturn. As the cold war priorities change it is not surprising that aerospace and government are expected to turn down. Jewelry and machine tools are also expected to turn down, which has no ready explanation.

Finisher Market Segments

Segment	1992 (sales weighted)	1993 (sales weighted)
Automotive	40.4%	47.9%
Consumer Durables	9.3%	7.9%
Recreational Goods	2.8%	3.1%
Aerospace	5.7%	4.6%
Machine Tools	4.4%	3.4%
Hydraulic Equipment	2.5%	2.0%
Electronics	10.8%	11.1%
Jewelry/Eye Glasses	3.0%	0.2%
Medical	2.2%	2.2%
Government	5.1%	4.4%
Job Shops	5.2%	7.8%
Others	8.6%	5.6%

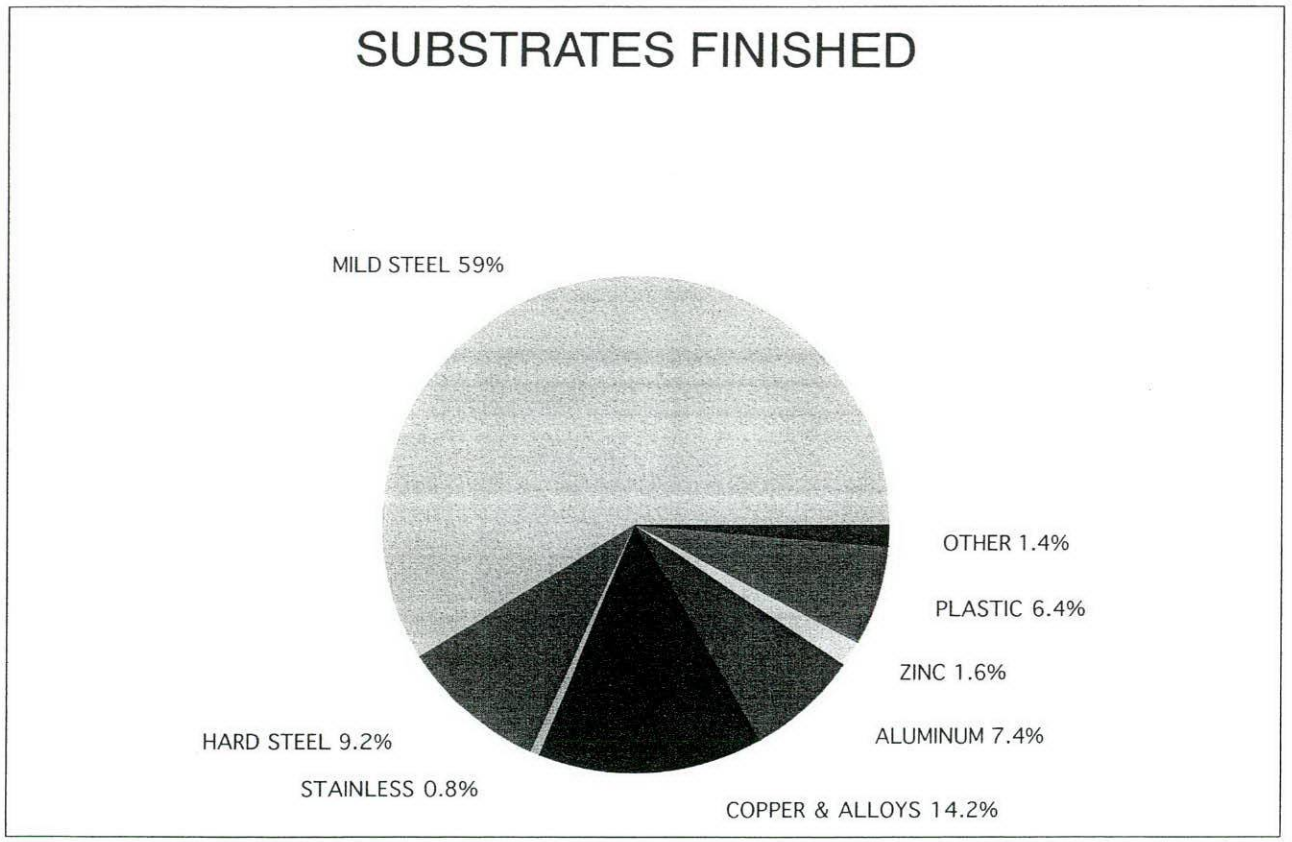
Substrates

Two hundred and forty-two facilities were reported with an annual average of 2,002,000 square foot plated per line. Metal finishing is mainly a steel substrate business accounting for 68.2% of the surface area finished. Copper and its alloys (brass, bronze, etc.) account for 14.2%, followed by aluminum at 7.4% and plastics at 6.4%. Zinc diecasting is believed to be under-reported as these substrates were often reported in pounds, not square feet. No useful conversion factor to square feet could be established.

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Metal Finishing Substrates

Mild Steel	59.0%
Hard steel	9.2%
Stainless Steel	0.8%
Copper Alloy	14.2%
Aluminum	7.4%
Zinc	1.6%
Plastic	6.4%
Other	1.4%



Metal Finishing Equipment

One hundred and sixty nine facilities were reported with an average of 2.2 plating lines per shop. The most common types of equipment were manually operated hoists, hand lines and automatic hoists respectively. These three types of equipment account for nearly 80% of the installed capacity. Although it may be related to the higher percentage reporting by job shops, equipment to run barrels only accounts for 37% of all lines. Rack lines account for 31% and the balance are either dual purpose or reel-to-reel.

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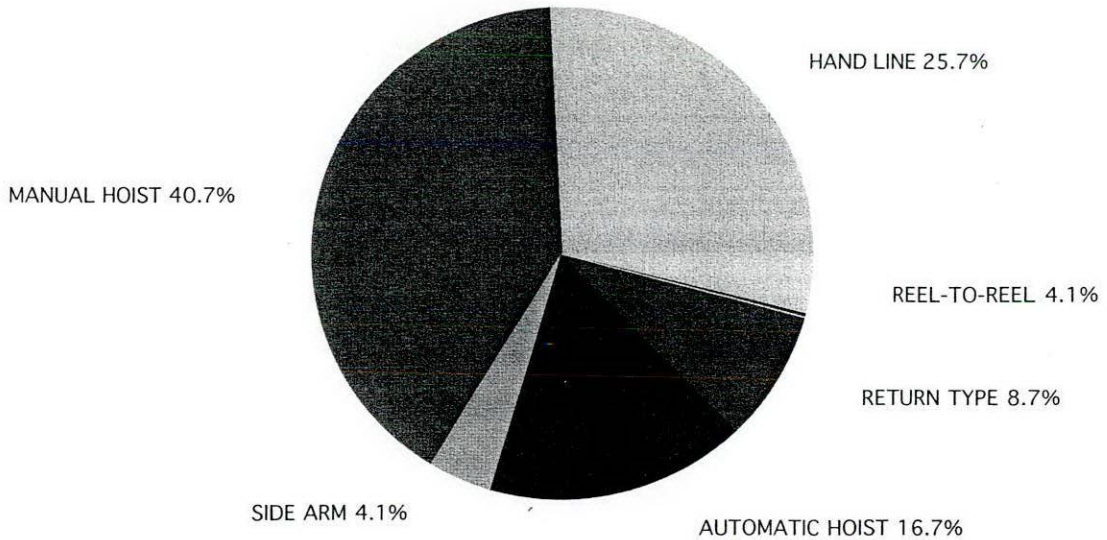
Extent of Automation in Metal Finishing Shops

Type	%
Handline	25.7%
Manual Hoist	40.7%
Sidearm	4.1%
Automatic Hoist	16.7%
Return Type	8.7%
Reel to Reel	4.1%

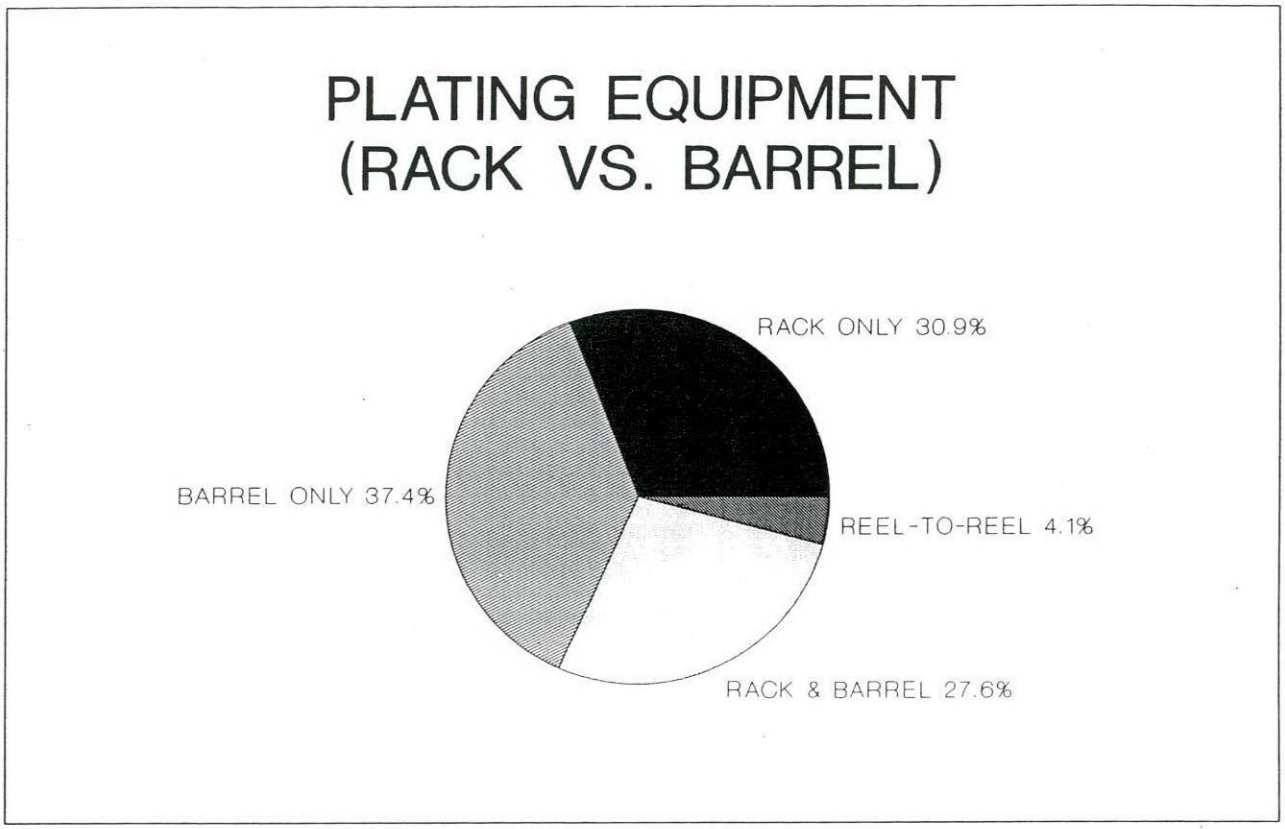
Rack vs Barrel Systems

Equipment	Percentage
Barrel Only	37.4%
Rack Only	30.9%
Reel to Reel	4.1%
Rack & Barrel	27.6%

PLATING EQUIPMENT



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Materials Usage by Finishers

The most frequently reported materials are shown below. They are listed by the descending number of shops indicating use of the material. Zinc and related materials, bright nickel, cyanide copper, and chromium plating predominate. Electroless nickel was reported by 17 users while the next most commonly used reported material was only reported by 12 users. Values for the annual consumption per tank and consumption per tank gallon are shown. There is no definition for miscellaneous surface preparations as this was the catch-all category for things that were not soak cleaners, strippers, electrocleaners, etc. The SFMRB is concerned about the accuracy (high value) of the electrolytic nickel anode data, but no obvious error in the questionnaires was found.

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Materials Usage by Finishers

Materials	Expenditures ($000)	Number Reporting	Avg.$ ($000)	Avg. $ per tank gal.
Pure zinc anodes	$730.9	46	15.9	6.62
Hex-Cr	$141.1	40	3.5	4.42
Bright Ni	$801.5	39	20.6	9.75
Acid Zn e-galvanizing	$802.1	26	30.8	9.92
Chromic acid	$139.9	26	5.4	3.52
Catalyst with chromic acid	$156.2	24	6.5	4.77
Cyanide Cu	$77.4	23	3.4	3.08
Electrolytic Ni anodes	$2505.0	22	113.9	32.34
Misc. surface preps.	$2176.5	22	98.9	43.51
Sodium cyanide	$100.7	20	5.0	2.93
Trivalent chromates	$56.8	20	2.8	7.37
Electroless Ni	$616.3	17	36.3	88.29

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MATERIAL SUPPLIERS

Proprietary Chemicals

In order to avoid any risk of competitive information being publicly divulged in this study, only those materials with 10 or more suppliers reporting are shown below. The most frequently sold products tend to be cleaners, electroless nickel, zinc plating materials and their related chromates, bright nickel, and coppers—cyanide and acid. Only 1992 data is shown as there were problems with some of the 1993 data being doubled to full year values in a fraction of the questionnaires. In terms of sales value, the electroless nickels and bright nickels are the largest shown. Nickel anodes would be in the same order of magnitude, but are omitted here because of the small number of importers or manufacturers.

SFMRB believes that about two-thirds of the large and middle sized suppliers reported their data.

Sales by Material Suppliers

Material ($000)	1992 Sales Reporting	Number
Soak cleaners	$8955	18
Electroless nickels	$37918	17
Electrocleaners	$8764	17
Alkaline non-cyanide zincs	$4677	16
Acid zincs and electrogalvanizing	$8183	16
Bright nickels	$13213	15
Hexavalent chromates	$7565	14
Cyanide zincs	$1609	14
Cyanides coppers	$1509	14
Acid activators	$3033	14
Parts strippers	$4629	13
General use acid coppers	$7594	12
Other PWB processes	$8863	10

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Employees and Sales

Based on responses from 47 material suppliers, they are typically not much larger than their average customer with about 39.5 employees. Their average annual sales revenues are $177-183,000/employee. Part of this relatively high value may be related to the supply of anodes and salts in high volumes via telemarketing, a low labor intensive approach. The other consideration is due to the extensive use of distributors whose sales and employee head count are not included. SFMRB estimates that distributors account for 50-60% of sales to end user customers.

Material Supplier Statistics

Year	Sales Revenue ($000)	Average No. Employees	Average Sales/supplier $000)	Average Sales/Employ	Average Cust./Suppl'r
1992	$319,000	38	$6,945	$183,000	275
1993	$340,000	41	$7,238	$177,000	308

Based on an independent study of the key industry supplier directories, it was estimated that there are about 180 different material manufacturer/supplier companies (no distributors included) serving the consumable needs of the metal finishers. Using the sales per employee ratios calculated earlier, we estimate an annual metal finishing material supplier business of approximately $1.25-1.3 billion in 1992-3.

Size of Material Supplier Business

Year	MF Sales per employee	Estimated Number of Suppliers	Total Supplier Employees	Total Sales Revenue ($bil)
1992	$183,000	180	6840	$1,250
1993	$177,000	180	7380	$1,300

Metal Salts

Only very limited information was received from manufacturers or importers of chemical salts such as nickel sulfate, copper sulfate, chromic acid, etc. For many of these materials, there are only two to four suppliers. Most of them expressed concern that contributing this information to SFMRB would weaken their competitive position. This will be an issue to hopefully resolve in future years, but for now no meaningful metal salt statistics can be reported.

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Anodes

Although there was privileged information provided on the total nickel anode market by one of the major suppliers, there was generally not enough data given to define the copper, zinc, tin, cadmium, and other anode volumes. Improving this information will be one of the key objectives for SFMRB during the next cycle.

Surface Preparation

Data was not available from a large enough fraction of the cleaner and surface preparation suppliers to enable any scaling of shop usage to total demand. A simple, historic estimate of cleaners and strippers as 30% of total proprietary chemical sales is the best the SFMRB can suggest at this time. Enhancing the information on cleaners and surface preparation material will be a focus two years out, assuming the other issues on anodes and shop usage can be solved.

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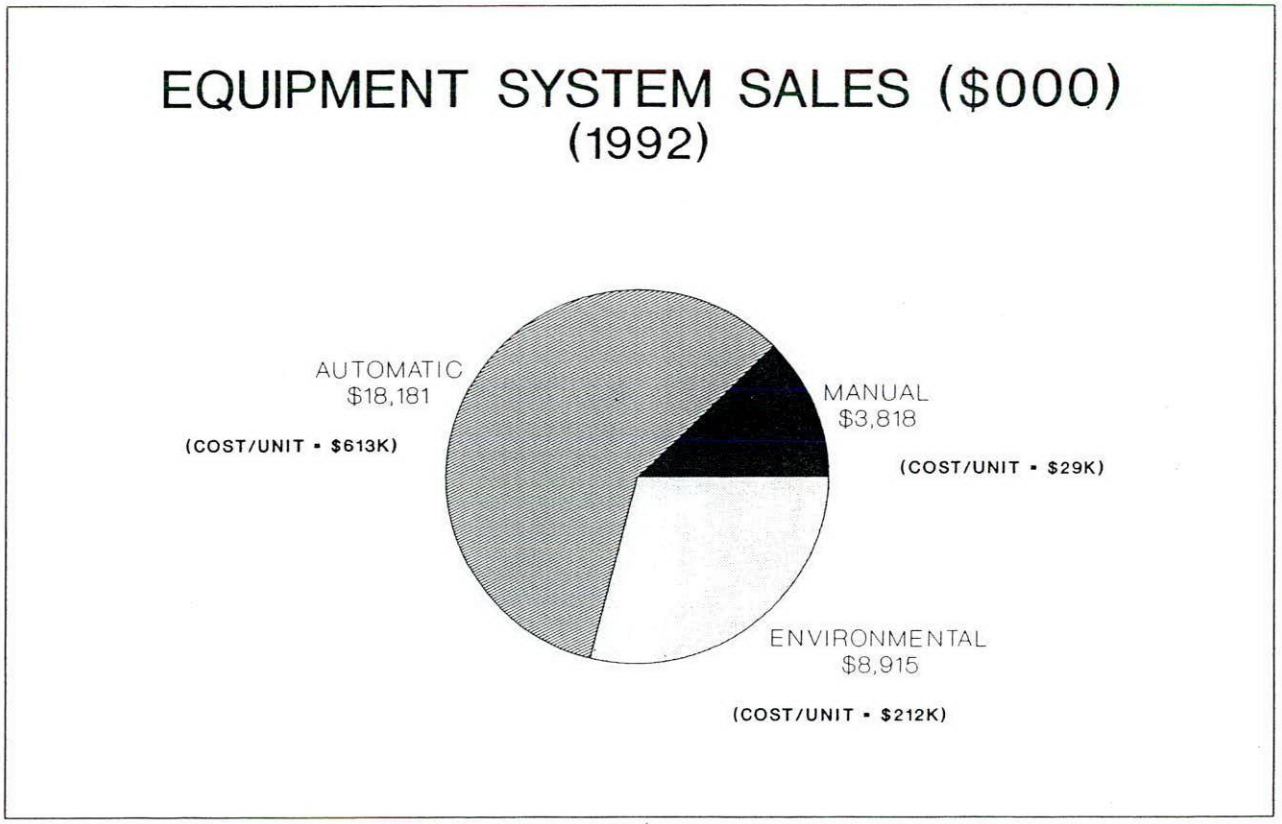
EQUIPMENT SUPPLIERS

System Sales

Seventeen supplier companies reported the following total sales of manual plating, automatic processing and wastewater treatment systems. Manual systems sold for an average of $29,000 each, automatic systems for $613,000 each and environmental systems for $212,000.

Equipment System Sales

Year	Manual ($000)	Automatic ($000)	Environ't'l ($000)
1992	$3,818	$18,181	$8,915
1993	$6,632	$18,040	$9,430



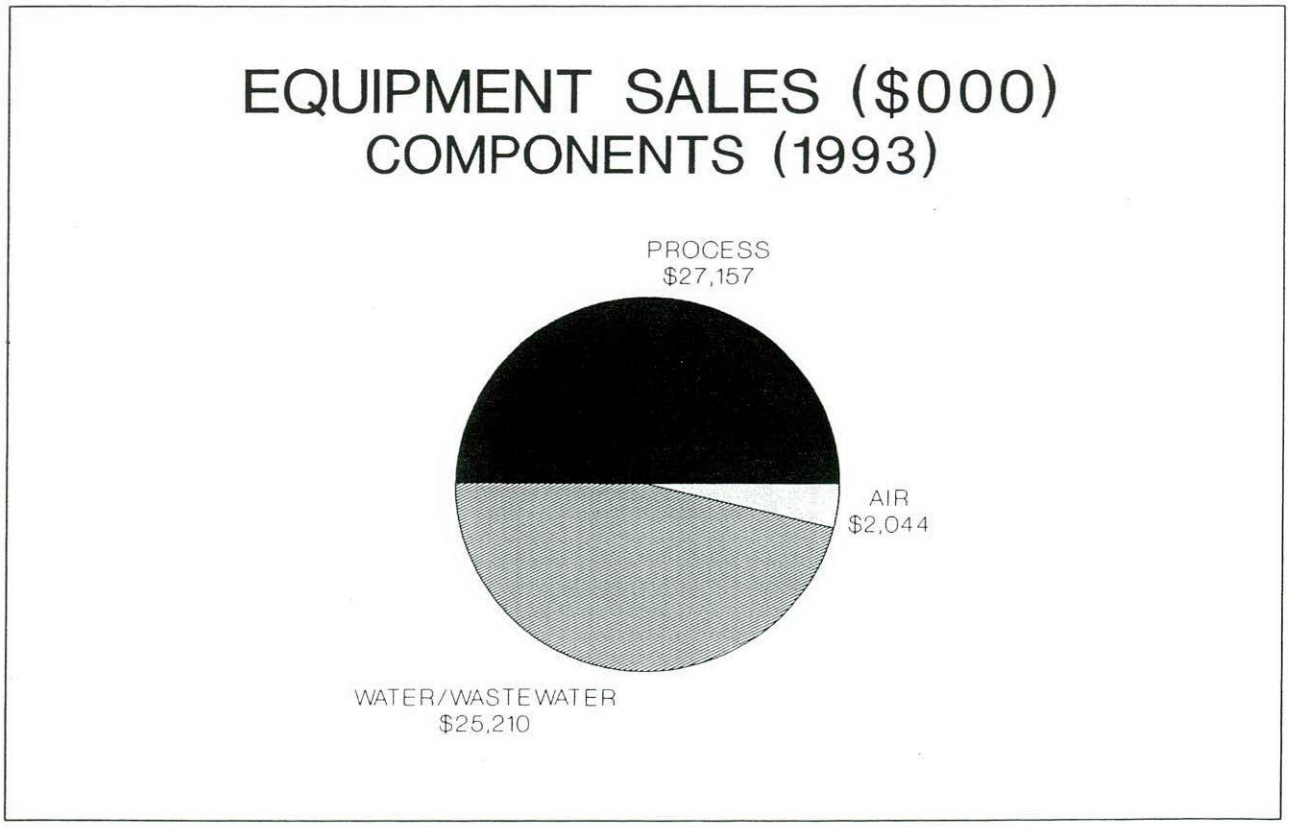
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Components Sales

Thirty-seven supplier companies reported the total sales below of process, wastewater treatment and air handling components.

Equipment Sales
(Components)

Year	Process ($000)	W & WW ($000)	Air ($000)
1992	$24,951	$21,340	$75
1993	$27,157	$25,210	$2,044



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Employment and Sales

Based on the data provided, metal finishing equipment suppliers have an average of 18.5 employees, $1,932,000 in annual sales and $104,000 in sales per employee.

Overall Equip't Supplier Statistics

Year	Metal Finishing Related Employees	Average No. Metal Finishing Employees	Average Sales/co. ($000)	Sales per Employ. ($000)	Ave. No. Metal Finishing Customers
1992	523	18.7	$1,913	$102	153
1993	515	18.4	$1,953	$106	145

From the above ratios (average number of employees and sales per employee) along with an estimate of 500 equipment suppliers (based on an independent review of industry supplier directories) the metal finishing plating related equipment business is estimated to employ 9200 people with sales of approximately $1.0 billion annually. This translates into $85,500 in annual equipment purchases per finisher or about 3.5% of the average annual job shop sales revenue.

Overall Size of Metal Finishing Equipment Business

Year	Ave Number Metal Finishing Employees	Metal Finishing Sales per Employee ($000)	Estimated Number of Suppliers	Total Supplier Employees	Total Equipment Sales Revenue ($000)
1992	18.7	$102	500	9340	$957,000
1993	18.4	$106	500	9195	$977,000

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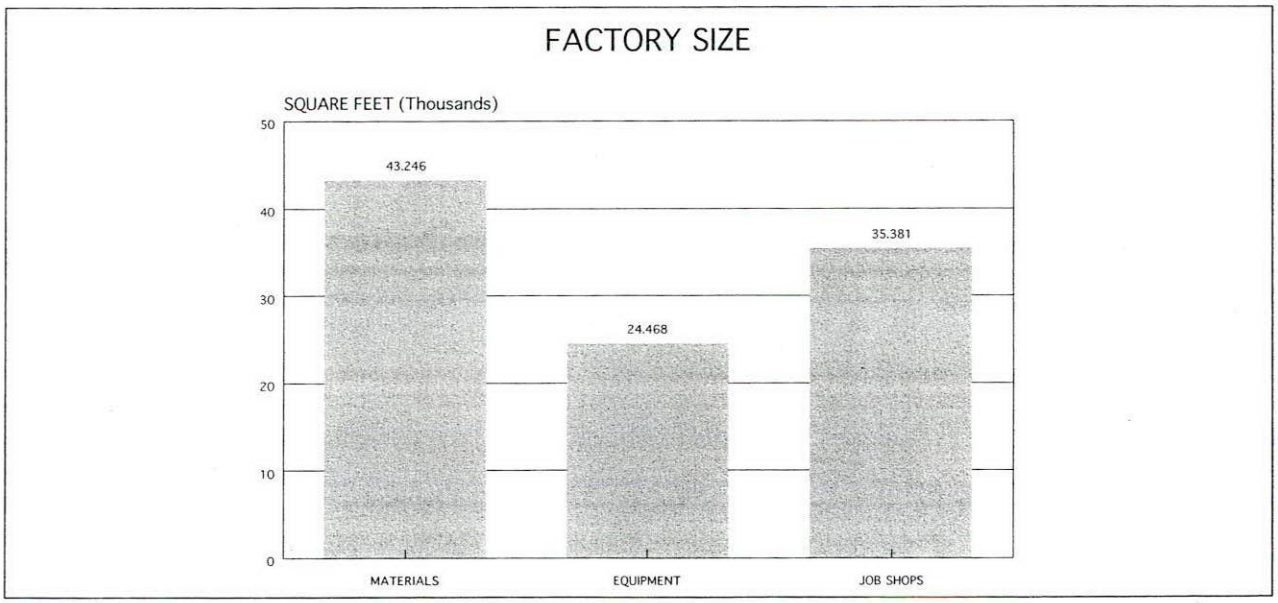
OVERALL METAL FINISHING BUSINESS

Factory Size

The relatively small size of equipment supplier facilities is speculated to reflect their large-scale reliance on sub-contractors and limited need for inventory space. Similarly, consumable material suppliers may make wide spread use of public warehouses, which would keep these numbers low.

Factory Sizes
(Average Square Feet)

Materials Suppliers	43,246
Job Shop Platers	35,381
Equipment Suppliers	24,468



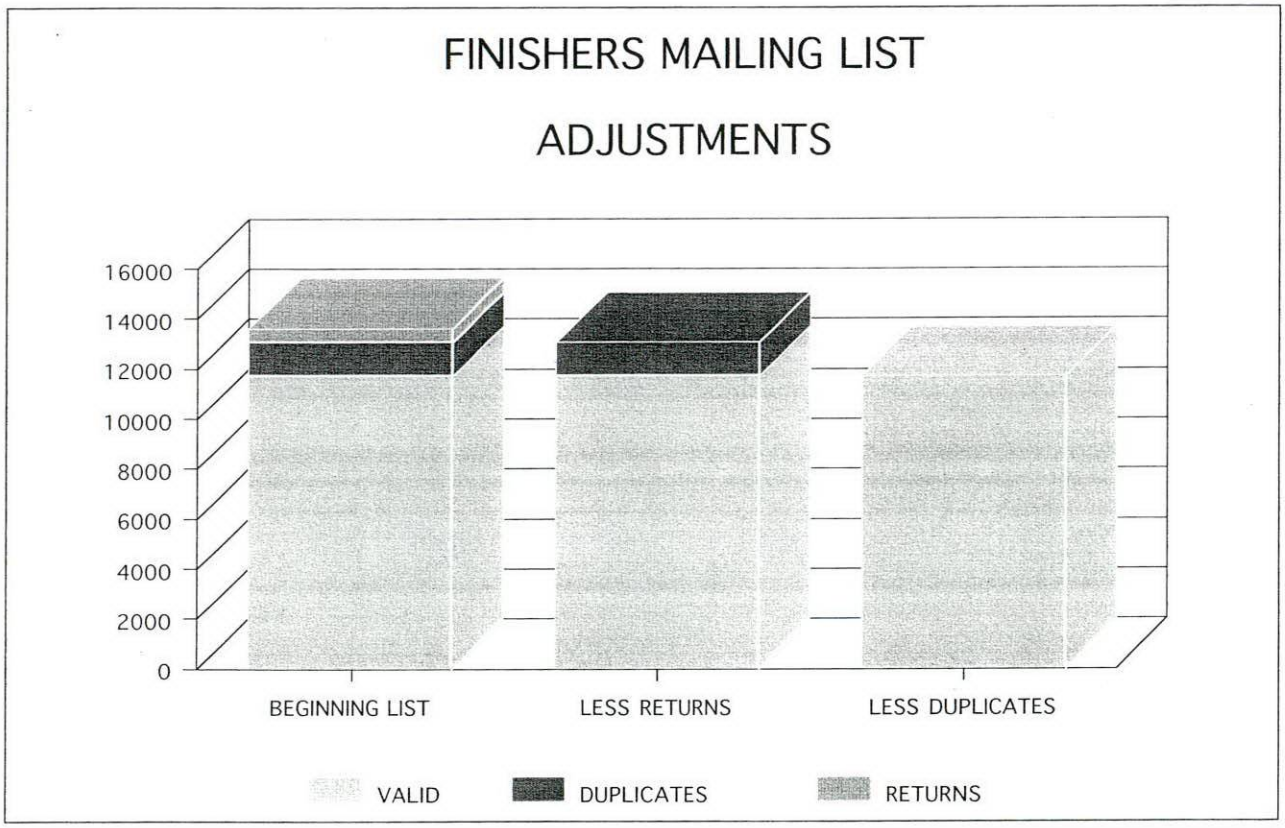
The Metal Finishing Universe

The first estimate of the total number of the U.S. and Canadian metal finishers came from the merged mailing list provided to the SFMRB. The 10% allowance for duplicates, duds, etc. comes from a one-time perusal of the list looking for obvious consultants, distributors, associations, government agencies, etc. There were returns of SFMRB questionnaires sent back saying that no metal finishing activity was taking place. These numbers should include coil coaters, anodizers, polishers, vacuum coaters, etc. Although there is considerable sentiment among the SFMRB that this universe is too large, there is no objective basis on which to scale back further.

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Universe of Metal Finishers
(Estimated from mailing list)

Merged mailing list	13621
Less allowance for duplicates (10%)	(1362)
Merged less duplicates	12259
Less returns (4.5%)	(552)
Total Number of Finishers-Estimate	**11,707**



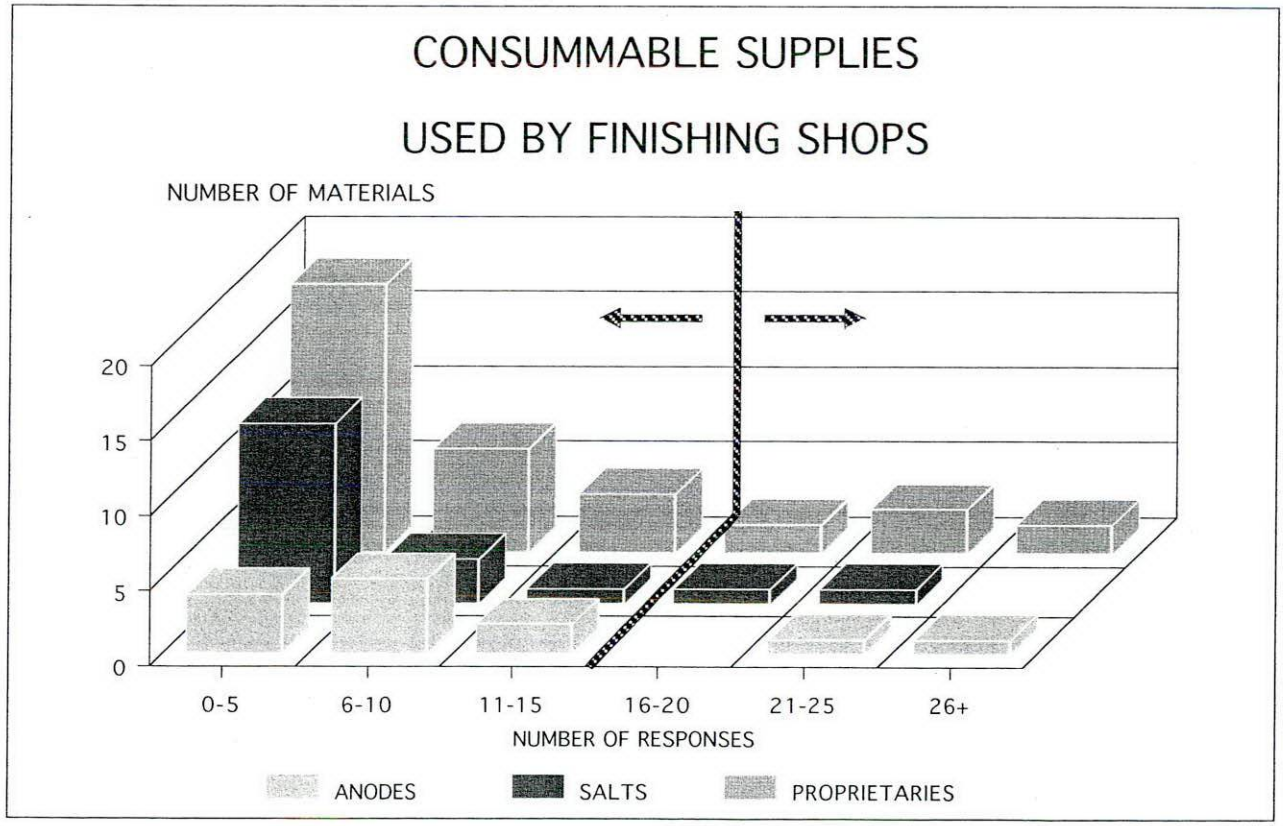
Data Available

If meaningful statistical analysis requires at least 25 respondents, then this was only achieved in three categories, as illustrated in the next table. If we bend this "meaningful" rule to include 16 or more responses, then seven proprietary chemical materials, two metal salts and two anodes qualify. These were used to develop the total universe of plating shop statistics. The metal salts data were set aside per the above discussion.

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Consumable Supplies
(Reported by Finishing Shops)

Number of Facilities Reporting	Proprietary Chemicals	Salts	Anodes
0 to 5	18	12	4
6 to 10	7	3	5
11 to 15	4	1	2
16 to 20	2	1	0
21 to 25	3	1	1
26+	2	0	1
Total Processes Reported	**36**	**18**	**13**



Clearly the processing data reported in the survey is an area with disappointing results. Different approaches are being considered by the SFMRB for next year's efforts to improve the available data . All the new approaches eliminate the current long questionnaire, which received some criticism.

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Number of Plating Shops

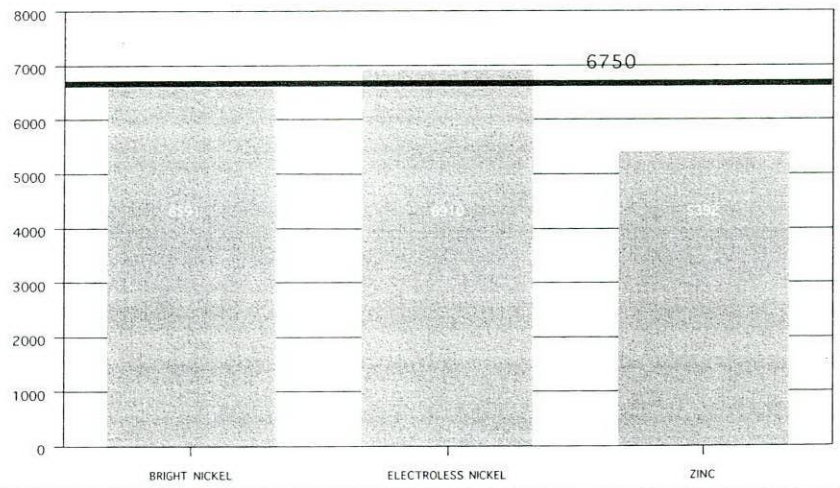
The total number of U.S./Canadian plating shops (the universe) is likely to be close to 6750 as calculated from three independent process bases. The estimate based on zinc is the least confident based on fewer data points being available. These estimates were scaled off the materials cost/tank data from the reporting shops, fraction of shops using this process, number of tanks/shop, and total size of consumable sales in that area. Obviously, not every supplier reported their consumable sales. An estimate was made of the fraction of large and medium size vendors reporting. This was used to scale up the statistics to total consumable sales. These statistics were then submitted to MFSA's CPA who indicated the degree of agreement with MFSA's own internal indices. In all cases, agreement was acceptably close and no further adjustments were made. Typically, two-thirds of large and medium consumable material vendors fully supported SFMRB by providing data. The only exception was in the precious metal material supplier area, which was much lower.

Plating Facility Estimates
(Shops Doing Plating)

	Total Estimated Number of Shops
Based on Bright Nickel Plating Analysis:	**6591**
Based on Electroless Nickel Plating Analysis:	**6910**
Based on Zinc Plating(Acid, CN, & Alk.) Analysis:	**5392**

NUMBER OF PLATING SHOPS

BEST ESTIMATE



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IPC

Courtesy of SFMRB's mentoring organization, the IPC's T/MRC, we have the following statistics related to bare board production in the U.S. and Canada. The sales values include laminate, drilling, photo-imaging, etc. as well as plating. Developing, in conjunction with IPC, a factor to apply to this total that represents wet processing will be a future activity for the SFMRB.

PCBs

Category	No. Facilities	Revenues ($000,000)
Independents	750	$3,378
Captives	20	$1,538
Totals	770	**$4,916**

Size of Metal Finishing Business

In summary, it is estimated that the metal finishing industry of North America involves more than 12,000 companies with nearly 520,000 employees. This assumes 42.3 employees per finisher and a 50/50 ratio of job shops to captives. The estimated GDP contribution from the metal finishing industry segment is nearly $47 billion or around 1% of the annual U.S total.

The "other finishing" category, in the next table, is an educated estimate and was not part of the detailed analysis conducted for the plating segment. It was assumed that they had the same sales/employee ($82,500) and employee/company (42.3) ratios as the plating finishers. The other finisher statistics includes such operations as painting, powder coating, phosphating, coil coating, polishers and vacuum coaters.

The final estimated 180 proprietary material manufacturer/suppliers below, is much lower than the 1425 on the initial mailing list, as it was determined that the initial list contained many distributors and resellers. These were not included in the final numbers to eliminate duplication.

The other material supplier estimates were based on the finishers' expenditure of 14% of revenue on all materials. These suppliers were not analyzed in this study.

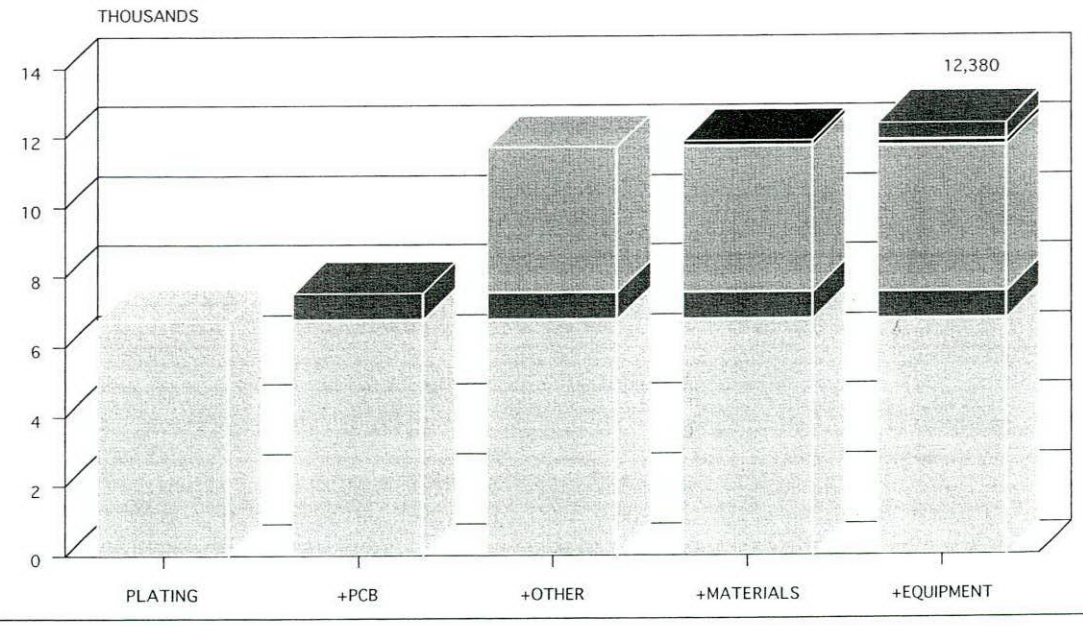
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Employee and GDP Impact of Metal Finishing Business

Category	Number of Companies	Number of Employees	Sales per Employee	GDP Contribution ($000,000,000)
Job Shops and Captives				
•Plating	6750	285,500	$82,500	$23.6
•PCB	770	40,000	$122,300	$4.9
•Other Finishing	4180	176,800	$82,500	$14.6
Finishing Materials	180	7100	$180,000	$1.3
Other Materials	?	?	?	$1.4
Equipment Suppliers	500	9200	$114,000	$1.0
TOTALS	**12,380**	**518,600**		**$46.8**

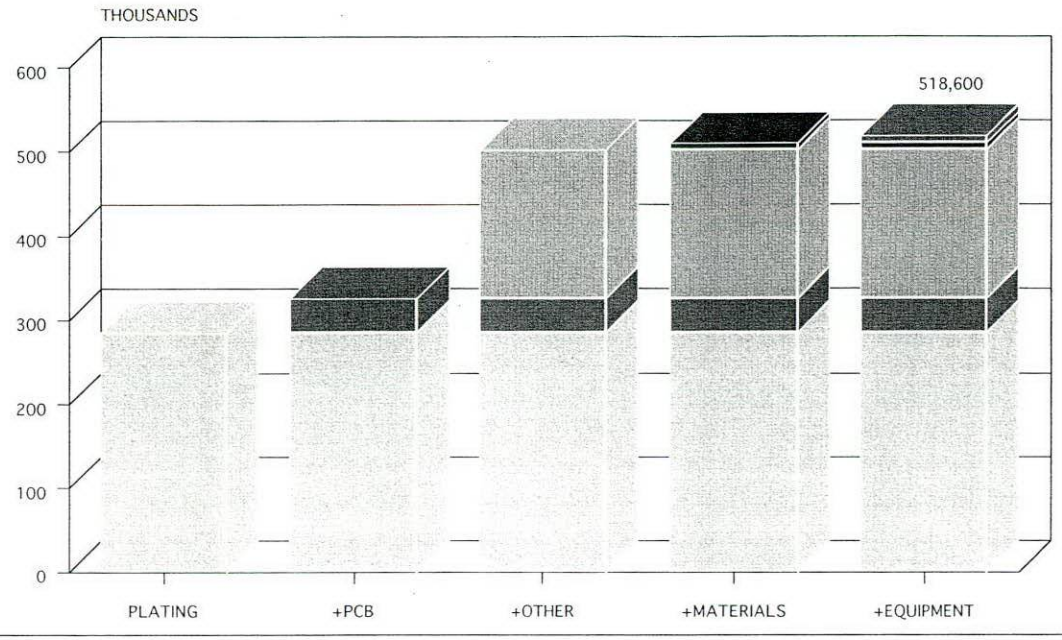
NORTH AMERICA

NUMBER OF FINISHING FIRMS

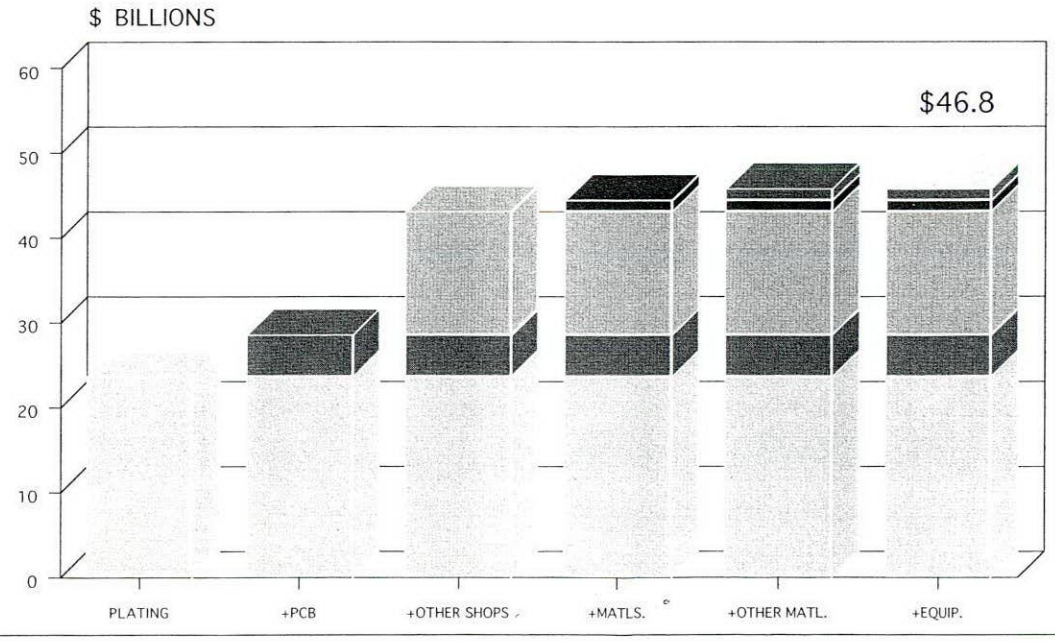


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NORTH AMERICA
NUMBER OF FINISHING EMPLOYEES



NORTH AMERICAN FINISHING
GDP CONTRIBUTION ($ BILLIONS)



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Future

In future years, the SFMRB will work with the non-responding firms to encourage more cooperation.

Verification of the finishing shop list by direct contact, such as phone follow-up would be prohibitive. SFMRB's current budget is $35,000/ year and should be expanded with additional participation; but is, and will be, a bargain to the industry.

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Al Coppola	Enthone-OMI
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Industry Council

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National Association of
Metal Finishers

MOVING FORWARD TOGETHER

SFMRB

Surface Finishing Market Research Board

METAL FINISHING INDUSTRY MARKET SURVEY

REPORT NO. 5

PURCHASING PRACTICES AND TECHNOLOGY TRENDS

MOVING FORWARD TOGETHER
SFMRB
Surface Finishing Market Research Board

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METAL FINISHING INDUSTRY MARKET SURVEY

REPORT NO. 5

PURCHASING PRACTICES AND TECHNOLOGY TRENDS

This report is published under the auspices of the Surface Finishing Industry Council (SFIC) by the American Electroplaters and Surface Finishers Society (AESF), the Metal Finishing Suppliers' Association (MFSA), and the National Association of Metal Finishers (NAMF) as a service to the metal finishing industry and contains information based on input from companies in the industry. The information published in this report was developed from actual historical information and does not include any quantitative projected information.

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Executive Director: Ted Witt

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MFSA

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NAMF

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General Super Plating Co. Inc.
Executive Director: David Barrack

National Association of Metal Finishers
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EXECUTIVE SUMMARY

In recognition of the need for statistical information on the metal finishing industry and under the auspices of the Surface Finishing Industry Council (SFIC), the American Electroplaters and Surface Finishers Society (AESF), the Metal Finishing Suppliers' Association (MFSA), and the National Association of Metal Finishers (NAMF) jointly support the Surface Finishing Market Research Board (SFMRB). The board is composed of representatives of the sponsoring organizations, who meet to discuss methods to gather the data of interest, implement these methods, and then compile and report results.

This report is the fifth in a series. The initial report was completed in 1994, with subsequent reports published in 1995, 1997, and 1998. This report confirms and updates some of the previous data and also provides new information on purchasing practices, technology trends, and sludge disposal practices.

Some of the key findings, which are further detailed in the text, tables, and figures of the report, were as follows:

- Captive and job shop finishers consider quality more important than price when selecting a vendor.
- Excluding price and quality the most important criterion in supplier selection for both captive and job shop finishers is technical service.
- The great majority of both captive and job shop finishers use proprietary chemicals for their process solutions in preference to "home brews."
- Electroless copper and electroless nickel plating are expected to show the highest growth among finishing processes in job shops over the next two years.
- Tin-lead plating is expected to show the highest growth among finishing processes in captive shops over the next two years.
- Carbon steel and stainless steel substrates are the most widely handled by finishers followed by aluminum and aluminum alloys.
- The average finishing shop disposes of 23.2 tons per year of F006 characteristic waste sludge.
- Approximately 40% of finishing shops send their F006 sludge for recycling.

Diskettes containing the data upon which this report is based, using a Microsoft Excel spreadsheet format, are available at an additional fee. SFMRB will also offer customized analyses and reports based on the data for a fee to be negotiated. (Minimum $500)

PURPOSE OF SFMRB

The metal finishing industry in North America has been faced with dramatic economic, technical, and regulatory challenges in recent decades. An industry under diverse pressures needs basic statistical information to know where it stands and to guide its future course. The Surface Finishing Market Research Board (SFMRB) was created in 1991 to meet this need.

SFMRB is managed by the Surface Finishing Industry Council (SFIC), which is funded and supported by the American Electroplaters and Surface Finishers Society (AESF), the Metal Finishing Suppliers' Association (MFSA), and the National Association of Metal Finishers (NAMF). The first two SFMRB reports, completed in 1993 and 1995, focused mainly on the status of the electroplating portion of the metal finishing industry. The third and fourth SFMRB reports, completed in 1997 and 1998, also reported on the industry status, but in addition included data on ten areas of high interest to the sponsoring members.

The information in these reports helped both metal finishers and their suppliers to make better decisions regarding areas for business development and provide the industry with more detailed information regarding employment and commercial activity for use in presentation to governmental and regulatory bodies.

This year's survey explored several new areas of interest including:

- Purchasing practices
- Technology trends
- Sludge disposal practices

METHODOLOGY

The SFMRB used a mailing list supplied by an industry trade publication (*Products Finishing*), which also offered to handle the mailing, printing, and collection of returns at minimal expense. The list was provided without rental charge. A random selection was made from the list, which consisted of only captive and job shop metal finishers in the United States who conducted the operations concerned in the survey questions. The questionnaires were designed to be anonymous, brief, and easy to fill out. Each questionnaire was sent with a strong covering letter and a dollar bill to further encourage participation.

SURVEY RESPONSE

The survey was mailed in the Fall of 1998 to 2,000 U.S. captive and job shops believed to be engaged in plating, anodizing, and electropolishing operations. It posed questions related to the above mentioned areas of interest plus sales volume, employment, and society participation.

The response rate is summarized in Table 1. The rate of response was very good. A comparison with past surveys, by type of shop responding, is shown in Table 2. Although the total response in 1997 was better, there was a lack of response from captive shops. Thus, the response in 1998, although lower in total responses, was more balanced between captive and job shops. Considering the quality and quantity of the responses, SFMRB believes the values currently reported to be plus or minus 5 to 10% of reality.

Table 1 Survey Responses

	Fall 1997	**Fall 1998**
List Size	7938	8223
Number Mailed	2000	2000
Usable Returns	511	327
Response Rate	**25.5%**	**16.4%**

Table 2 Comparison of Facility Types Responding to Surveys

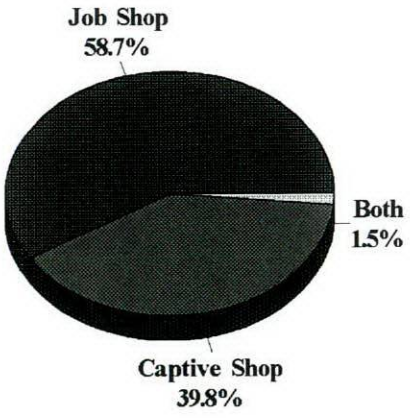
Survey	**Captive Shops**	**Job Shops**
1992-1993	32%	68%
1993-1994	22%	78%
1996-1997	53.4%	46.6%
Fall 1997	**11.9%**	**88.1%**
Fall 1998	**41.3%**	**58.7%**

BASIC INFORMATION

Business Orientation

Figure 1 shows the distribution of responses between captive and job shops. (A captive shop provides metal finishing services within a manufacturing company; a job shop provides metal finishing services for a fee.) The data are based on responses from 130 captive shops, 192 job shops and 5 combined captive and job shop operations, which have been treated as captive shops in the data analysis and in this report.

Figure 1 Type of Facility



Plant Locations

Figure 2 shows the eight areas used to group the responses geographically. Tables 3, 4, and 5 display all the responses broken down by percentage of plant sites in each of the eight U.S. regional areas and compare them with the previous survey. The distribution for all respondents (Table 3) compared favorably with the last survey with a larger number of plants located in the Western and West Central regions and slightly fewer in New England, the Mid-Atlantic, and East Central regions.

Job shop site locations in the eight U.S. geographical regions are shown in Table 4 and are compared to the previous report. The current responses are consistent with past surveys, with the exceptions as noted above. Captive shop site locations in the eight U.S. geographical regions are shown in Table 5. The survey indicates that the Midwest is the largest area for both captive and job shops, with over 40% of all finishers located in either the East or West Central regions.

Figure 2 Geographical Regions for Tables 3, 4 & 5

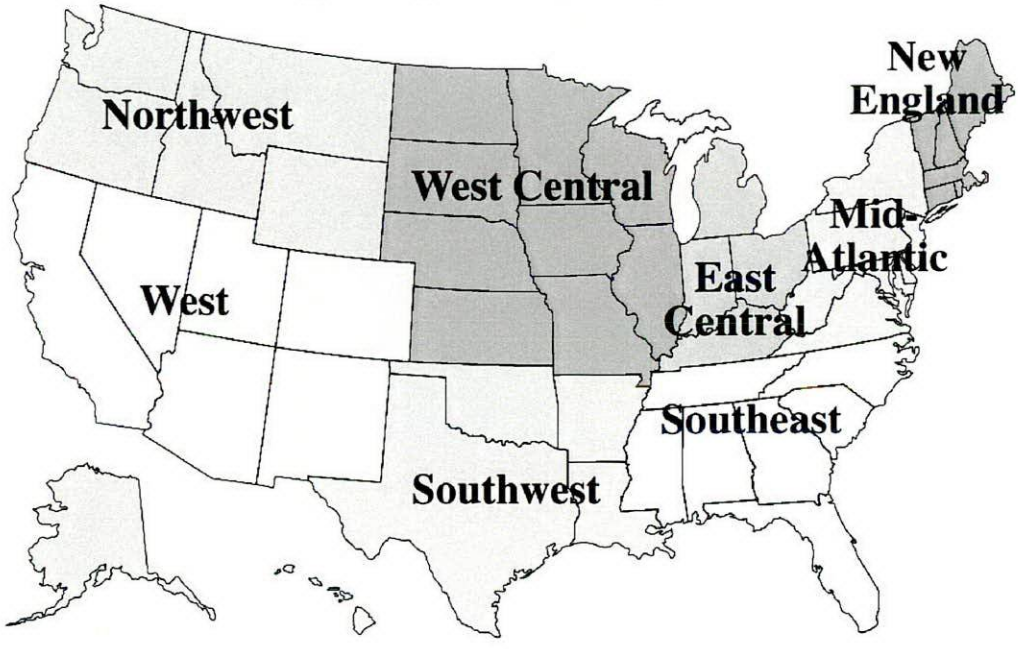


Table 3 Plant Locations of All Respondents

Region	Fall 1997	Fall 1998
New England	9.8%	7.9%
Mid-Atlantic	13.3%	13.2%
Southeast	7.3%	12.1%
East Central	20.3%	18.1%
West Central	19.5%	21.1%
Southwest	4.8%	6.9%
West	21.2%	17.8%
Northwest	3.9%	2.6%

Basis: 304 replies in 1998

Table 4 Job Shop Plant Locations

Region	Fall 1997	Fall 1998
New England	10.4%	6.7%
Mid-Atlantic	12.7%	13.5%
Southeast	6.4%	7.3%
East Central	20.5%	19.7%
West Central	19.8%	23.0%
Southwest	4.7%	6.7%
West	21.4%	19.1%
Northwest	4.0%	3.9%

Basis: 178 replies in 1998

Table 5 Captive Shop Plant Locations

Region	Fall 1998
New England	9.5%
Mid-Atlantic	12.7%
Southeast	18.2%
East Central	15.9%
West Central	19.0%
Southwest	7.1%
West	15.9%
Northwest	0.8%

Basis: 126 replies in 1998

Employment

Employment levels for captive and job shops are summarized in Tables 6 and 7 by the percentage of companies in each of nine size categories. The data indicate a median of 20 and an average of 39 job shop employees per facility. This compares to a median of 23 and an average of 40 job shop employees in last year's survey.

There is a median of 15 and an average of 42 captive shop employees per facility. This compares to a median of 18 and an average of 48 captive employees in last year's survey. The median is taken as the number of employees for the shop in the middle of the range, for example the third shop in a ranked list of five; while the average is the sum of all employees for all shops divided by the number of shops. For example for this set of values:

<3 - 20%
3-5 - 30%
5-8 - 40%
>8 - 10%

The average= 1.5 x 0.2 + 4 x 0.3 + 6.5 x 0.4 + 9.5 x 0.1 = 5.05

This survey shows high participation from smaller shops. The low median values, relative to the averages, illustrate the large concentration of small U.S. metal finishers who have l0 or fewer employees.

Table 6 Number of Job Shop Employees

Range	Fall 1997	Fall 1998
1-5	13.6%	16.1%
6-10	14.7%	16.1%
11-20	17.8%	18.2%
21-30	12.7%	12.0%
31-50	16.7%	14.1%
51-75	9.4%	10.4%
76-100	6.7%	4.7%
101-200	7.5%	5.7%
>200	1.1%	2.6%

Basis: 192 replies in 1998

Table 7 Number of Captive Shop Employees

Range	Fall 1997	Fall 1998
1-5	19.7%	22.4%
6-10	16.4%	17.9%
11-20	21.3%	18.7%
21-30	6.6%	5.2%
31-50	4.9%	14.9%
51-75	11.5%	6.7%
76-100	6.6%	2.2%
101-200	6.6%	6.0%
>200	6.6%	6.0%

Basis: 134 replies in 1998

Sales Volume

The 1998 sales volumes for 172 job shops are summarized in Table 8. The size distribution of job shops responding was comparable to past surveys. The median sales volume was $1.51 million (vs. $1.66 million in 1997) and the average sales per job shop were $3.2 million (vs. $3.0 million in 1997).

The 1998 sales volumes for 82 captive shops are summarized in Table 9. Forty-nine captive shop respondents (37.4%) did not know their metal finishing related sales. (This compares to 5.5% of job shop respondents who did not know their metal finishing sales.) The median captive sales volume was $1.33 million and the average sales per captive shop were $5.2 million. Captive shop sales were not reported for 1997. A comparison with data for 1996 is included in Table 9. Results are comparable to past surveys in that there are many small and large captive operations and fewer medium-sized operations. There is not a bell-shaped distribution for either captive or job shops.

Table 8 Job Shop Sales Volume

$ Millions	1997	1998
<0.25	8.7%	11.6%
0.25-0.5	11.0%	8.7%
0.5-1	15.6%	18.6%
1-2	22.1%	21.5%
2-3	13.3%	7.6%
3-5	12.9%	9.9%
5-7	5.3%	9.9%
7-10	5.3%	5.2%
10-15	3.4%	4.1%
15-20	1.2%	1.7%
>20	1.2%	1.2%

Basis: 172 replies in 1998

Table 9 Captive Shop Sales Volume

$ Millions	1996	1998
<0.25	36.6%	23.2%
0.25-0.5	*	8.5%
0.5-1	20.3%	13.4%
1-2	8.1%	14.6%
2-3	4.9%	6.1%
3-5	8.9%	6.1%
5-7	0.8%	1.2%
7-10	3.3%	3.7%
10-15	#	8.5%
15-20	#	6.1%
>20	17.1%	8.5%

Basis: 172 replies in 1998 (* included above # included below)

The average sales revenue for job shops from the past surveys has ranged from $2.5 million to $3.6 million, with revenue per employee ranging from $75,000 to $89,000. The current job shop data indicate an average of $82,000 in sales revenue per employee. The current captive sales data indicate an average of $123,000 in sales revenue per employee. Generally, data from captive operations in previous reports indicate a significantly higher ratio (compared to job shops), with fewer employees and a more automated operation.

PURCHASING PRACTICES

Survey respondents were asked to rate the importance of various criteria when selecting a supplier. Seven items ranging from reputation to credit terms were ranked on a scale from very important to not important. The results for job and captive shops are given respectively in Tables 10 and 11. Table 12 includes a weighted index. (Very important rankings were assigned 300, important 200, somewhat important 100, and not important zero.) Both groups ranked technical service as the most important selection criteria. Reputation/warranty and on-time delivery were ranked a very close second and third. Credit terms were considered the least important by both groups, especially so for captive shops.

Table 10 Job Shop Criteria for Supplier Selection

Criteria	Very Important	Important	Somewhat Important	Not Important
Technical Service	64.6%	28.0%	5.8%	1.6%
Reputation/ Warranty	54.8%	40.4%	4.3%	0.5%
On-Time Delivery	52.4%	38.6%	9.0%	0.0%
Latest Technolgy	33.0%	48.9%	16.0%	2.1%
Local Rep/Distributor	26.2%	49.2%	21.4%	3.2%
Extent of Product Line	14.0%	42.5%	34.9%	8.6%
Favorable Credit Terms	17.0%	38.3%	27.7%	17.0%

Basis: 186 replies

Table 11 Captive Shop Criteria for Supplier Selection

Criteria	Very Important	Important	Somewhat Important	Not Important
Technical Service	61.5%	36.2%	2.3%	0.0%
Reputation/ Warranty	53.1%	47.7%	4.6%	0.8%
On-Time Delivery	56.5%	34.4%	8.4%	0.8%
Latest Technolgy	32.8%	47.3%	17.6%	2.3%
Local Rep/Distributor	27.7%	47.7%	19.2%	5.4%
Extent of Product Line	15.4%	45.4%	33.1%	6.2%
Favorable Credit Terms	12.2%	26.0%	21.4%	21.4%

Basis: 130 replies

Table 12 Selection Criteria Index

Criteria	Captive Shops	Job Shops
Technical Service	259	256
Reputation/Warranty	252	250
On-Time Delivery	247	243
Latest Technology	211	213
Local Rep/Distributor	185	198
Extent of Product Line	170	162
Favorable Credit Terms	129	155

Table 13 indicates the relative importance for captive and job shops of quality and price in selecting a supplier. The results are also summarized in Figure 3. It can be seen that about 43% of both captive and job shops consider quality as equal to price in importance with about 40% deeming quality as more important. Only about 17% of both captive and job shops consider price more important than quality. It is conclusive that captive and job shop finishers consider quality more important than price when selecting a vendor with the agreement between the two types of shops is remarkable.

Metal finishers were asked how often they make a significant change of proprietary chemicals used for pretreatment and process baths. The responses are shown in Tables 14 and 15. It can be seen that fewer than 5% of job shops and fewer than 10% of captive shops change as often as once per year, while 75 to 80% don't change their proprietary chemicals more often than once every three years.

Table 13 Relative Importance of Quality and Price

Quality/Price	Captive Shops	Job Shops
100%/0%	3.8%	2.2%
90%/10%	13.7%	8.6%
75%/25%	22.1%	29.6%
50%/50%	43.5%	43.0%
25%/75%	10.7%	8.6%
10%/90%	3.8%	4.3%
0%/100%	2.3%	3.8%

Figure 3 Relative Importance of Price ($) and Quality

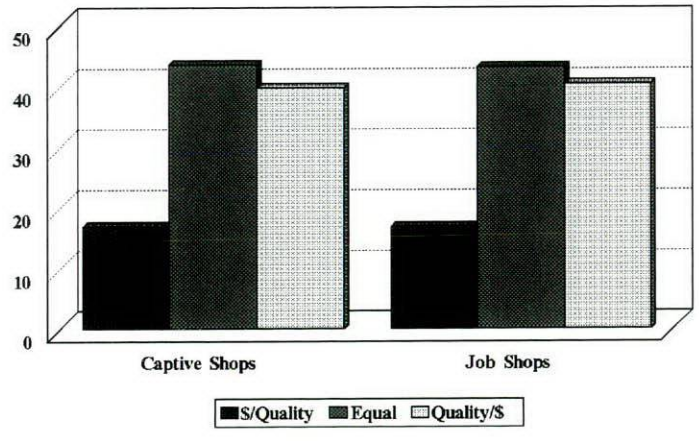


Table 14 Frequency of Change in Proprietary Chemicals for Pretreatment

Frequency	Captive Shops	Job Shops
Once per Year	8.4%	4.8%
Once in 2-3 Years	16.8%	15.3%
Seldom	74.8%	79.9%

Table 15 Frequency of Change in Proprietary Chemicals for Process Baths

Frequency	Captive Shops	Job Shops
Once per Year	6.9%	1.7%
Once in 2-3 Years	14.7%	15.4%
Seldom	78.4%	82.9%

MATERIAL USAGE

Processes Employed

The survey requested information on 28 of the most frequently used plating and surface treatment processes employed by both captive and job shops. Data were collected and are reported in this section on the percentage of each process used and the percentage of the purchased chemicals for each process that were proprietary. Also, the reported data were adjusted for the number of employees (relative to the average) of each responding metal finishing operation. Furthermore, to report and discuss the data, the processes have been grouped as follows:

- Nickel and Chromium
- Cadmium and Zinc
- Copper and Alloys
- Gold, Silver, and Tin
- Surface Treatments

Nickel and Chromium

Respondents were asked to indicate whether they used one or more particular processes involving nickel and/or chromium and also if they used proprietary chemicals or additives for these processes. The results for job shops are shown in Table 16. The percentages do not add up to 100% since many respondents are engaged in more than one process.

Table 16 Nickel and Chromium Plating in Job Shops

Process	% Used (Raw Data)	% Used (Size Adj.)	% Prop. (Raw Data)	% Prop. (Size Adj.)
Dec Cr (+6)	25.5%	25.5%	87.8%	89.4%
Hard Cr	18.8%	27.4%	61.1%	66.8%
Dec Cr (+3)	8.9%	15.0%	94.0%	99.7%
Electroless Ni	27.0%	27.2%	96.2%	87.6%
Sulfamate Ni	26.0%	33.6%	82.0%	87.7%
Watts Ni	35.4%	32.6%	76.5%	76.5%

In order to account for process usage by very small or very large shops, the data are reported both as received (raw data) and also adjusted for size based on employment. Thus responses from shops with double the employees of the average shop were doubled and responses from shops with half as many employees as the average shop were halved in determining the size-adjusted values. This weighting will therefore give a more realistic estimate of the total industry volume for each process.

Watts nickel, as expected, is the most commonly used process followed by electroless nickel and nickel sulfamate. The nickel sulfamate usage is much higher than anticipated. The size-weighted results show nickel sulfamate usage as being higher than Watts nickel. It is likely that some respondents who reported nickel sulfamate confused it with the nickel sulfate of Watts nickel. Conventional wisdom is that Watts nickel usage should be an order of magnitude higher than sulfamate.

Table 17 shows the results for captive shops. Once again the nickel processes predominate but when the data are adjusted for size the decorative hexavalent chromium is more than doubled while the other chromium processes also show substantial increases. If one adds the size-adjusted usage of decorative chromium processes for either captive or job shops it will be seen that they exceed usage of Watts nickel. This further supports the belief that respondents are confusing Watts and sulfamate nickel as the decorative chromium is invariably deposited onto a nickel base layer, almost always from a Watts-type electrolyte. It is interesting to note that electroless nickel is twice as likely to be used in job shops compared to captive shops.

Table 17 Nickel and Chromium Plating in Captive Shops

Process	% Used (Raw Data)	% Used (Size Adj.)	% Prop. (Raw Data)	% Prop. (Size Adj.)
Dec Cr (+6)	14.1%	27.5%	84.2%	96.0%
Hard Cr	9.6%	17.4%	84.6%	88.8%
Dec Cr (+3)	11.9%	17.4%	93.8%	88.8%
Electroless Ni	15.6%	13.0%	90.5%	90.4%
Sulfamate Ni	23.7%	20.0%	90.6%	92.9%
Watts Ni	23.0%	32.6%	87.1%	94.5%

Tables 16 and 17 also include information on whether respondents utilize proprietary formulations or prepare their own "home-brew" electrolytes. The vast majority purchase proprietary chemicals with captive shops more likely to do so. One major exception is hard chromium plating in job shops where about one-third prepare home brews.

Cadmium and Zinc

At one time cyanide zinc dominated the market for zinc electrodeposition. The results reported in Tables 18 and 19 indicate that this is no longer the case with cyanide zinc now the least favored process. The usage of cadmium continues quite strongly in job shops, but is much less favored by captive finishers, especially on a size-weighted basis. It is probable that job shops are more willing to bear the responsibility of environmental compliance with cadmium than are the captives. Acid zinc is the most popular process among both captive and job shop finishers, especially on a size-weighted basis. Job shops are also more likely to use alkaline zinc, which can provide better metal distribution, especially on complicated parts.

Acid and alkaline zinc processes tend to be proprietary in nature. Most job shops use proprietary materials for zinc alloys while about one-quarter of captive shops use a home brew. The highest instance of home brews is for cadmium in job shops with one-third reporting this item.

Table 18 Cadmium and Zinc Plating in Job Shops

Process	% Used (Raw Data)	% Used (Size Adj.)	% Prop. (Raw Data)	% Prop. (Size Adj.)
Cadmium	14.1%	19.4%	66.7%	65.1%
Acid Zn	20.3%	23.0%	97.4%	99.8%
Alkaline Zn	16.7%	19.2%	93.8%	93.7%
Cyanide Zn	6.8%	5.2%	76.9%	96.4%
Zn Alloys	7.3%	11.6%	92.9%	99.6%

Table 19 Cadmium and Zinc Plating in Captive Shops

Process	% Used (Raw Data)	% Used (Size Adj.)	% Prop. (Raw Data)	% Prop. (Size Adj.)
Cadmium	9.8%	4.2%	92.3%	96.4%
Acid Zn	12.6%	18.8%	82.4%	84.0%
Alkaline Zn	4.4%	9.7%	100%	100%
Cyanide Zn	4.4%	8.1%	66.7%	77.6%
Zn Alloys	6.7%	10.7%	77.8%	72.8%

Copper and Copper Alloys

As can be seen from Tables 20 and 21, acid and cyanide copper dominate this group for both captive and job shops. Brass plating processes are next in line with electroless copper on the same level only in job shops when size adjustment is taken into account. The continued use of cyanide copper is not surprising since it is widely used as a strike or preplate for ensuring adherence of subsequent multiple-layer deposits for hard-to-handle substrates such as zinc die castings.

Table 20 Copper and Copper Alloy Plating in Job Shops

Process	% Used (Raw Data)	% Used (Size Adj.)	% Prop. (Raw Data)	% Prop. (Size Adj.)
Brass	13.0%	12.0%	56.0%	61.1%
Bronze	4.2%	5.5%	37.5%	60.8%
Acid Cu	24.0%	29.7%	82.0%	93.7%
Alkaline Cu	6.3%	9.9%	91.7%	99.5%
Cyanide Cu	27.1%	25.5%	87.8%	90.6%
Electroless Cu	6.3%	12.9%	97.1%	99.7%

Table 21 Copper and Copper Alloy Plating in Captive Shops

Process	% Used (Raw Data)	% Used (Size Adj.)	% Prop. (Raw Data)	% Prop. (Size Adj.)
Brass	8.9%	*	58.3%	*
Bronze	3.7%	*	80.0%	*
Acid Cu	17.0%	21.9%	78.3%	76.6%
Alkaline Cu	3.0%	1.7%	100%	100%
Cyanide Cu	15.6%	20.4%	71.4%	57.5%
Electroless Cu	5.2%	4.3%	85.7%	93.1%

*insufficient response

Several of the processes in this group had high usage of home brews. In job shops nearly 40% do so for brass and bronze while 40% of captive shops, on a size-weighted basis, do so for cyanide copper. The responses for brass and bronze in captive shops were insufficient in number to accurately calculate size-adjusted values.

Gold, Silver, and Tin

Gold is the most frequently reported process of this group for both captive and job shops as shown in Tables 22 and 23. Acid tin is the most popular process, on a size-weighted basis, in this group with gold and tin-lead next in line. Gold is the most frequently used among the captive shops, when size is taken into account, followed by silver and acid tin.

As regards home brews nearly 45% of captive shops (size adjusted) use a home brew for acid tin and 25% do so for gold. About 20% of the job shops utilize a home brew for stannate tin processes.

Table 22 Gold, Silver, and Tin Plating in Job Shops

Process	% Used (Raw Data)	% Used (Size Adj.)	% Prop. (Raw Data)	% Prop. (Size Adj.)
Gold	21.3%	21.9%	92.7%	97.1%
Silver	17.7%	15.9%	85.3%	90.6%
Acid Tin	19.3%	29.5%	92.7%	98.7%
Stannate	12.5%	15.2%	72.7%	80.4%
Tin-Lead	12.0%	18.6%	82.6%	85.5%

Table 23 Gold, Silver, and Tin Plating in Captive Shops

Process	% Used (Raw Data)	% Used (Size Adj.)	% Prop. (Raw Data)	% Prop. (Size Adj.)
Gold	20.7%	24.2%	89.3%	75.2%
Silver	16.3%	13.6%	86.4%	89.8%
Acid Tin	9.6%	12.8%	76.9%	55.8%
Stannate	4.4%	7.8%	66.7%	99.3%
Tin-Lead	7.4%	10.3%	90.0%	99.4%

Surface Treatments

In addition to seeking information on plating processes, data were also sought for a number of related metal finishing treatment processes. These results are reported in Tables 24 and 25. Processes for cleaning and pretreatment, as expected, are the most widely used by both captive and job shop finishers. Stripping is in use in over 60% of the job shops and over 40% of the captive shops. Chromate conversion coatings are also widely used in about one-half of the job shops and one-third of the captive shops. Anodizing is more likely to be used in job shops while electropolishing is more frequently found in captive shops. Hardcoating usage is about the same for both captive and job shop finishers.

On a size-adjusted basis about one-half the job shops and two-thirds of the captive shops use home brews for their anodizing and hardcoating operations. One-quarter of the job shops use a home brew for electropolishing. The remaining processes tend to be proprietary.

Table 24 Surface Treatments in Job Shops

Process	% Used (Raw Data)	% Used (Size Adj.)	% Prop. (Raw Data)	% Prop. (Size Adj.)
Anodize	21.4%	27.7%	17.0%	45.9%
Hardcoat	14.1%	18.8%	63.0%	52.0%
Chromate	42.7%	51.5%	91.5%	94.4%
Electropolish	14.6%	10.6%	75.0%	73.8%
Pretreatment	76.6%	82.4%	91.2%	88.6%
Stripping	61.5%	68.6%	66.1%	68.5%

Table 25 Surface Treatments in Captive Shops

Process	% Used (Raw Data)	% Used (Size Adj.)	% Prop. (Raw Data)	% Prop. (Size Adj.)
Anodize	17.0%	14.1%	47.8%	35.4%
Hardcoat	15.6%	13.2%	52.4%	33.6%
Chromate	31.1%	31.8%	95.2%	90.0%
Electropolish	17.0%	22.8%	78.3%	84.2%
Pretreatment	60.7%	74.7%	91.6%	95.3%
Stripping	42.2%	58.2%	80.7%	84.9%

Most Popular Plating Processes

The ten most popular plating processes, based on Tables 16 to 23, are reported in Tables 26 to 29. Table 26 lists the ten most popular plating processes in job shops in order of frequency and Table 27 provides the same information on a size-weighted basis. Watts nickel is the most popular with sulfamate nickel first on a size-weighted basis. As noted earlier, it's likely that respondents were confused in reporting nickel plating and that nickel sulfamate usage is overstated. After nickel electroplating a number of processes are bunched together including electroless nickel, acid copper, decorative chromium (+6), and others.

Table 26 Ten Most Popular Job Shop Plating Processes

Process	Usage
Watts Ni	35.4%
Cyanide Cu	27.1%
Electroless Ni	27.0%
Sulfamate Ni	26.0%
Acid Cu	24.0%
Dec Cr (+6)	22.5%
Gold	21.3%
Acid Zn	20.3%
Acid Sn	19.3%
Hard Cr	18.8%

Table 27 Ten Most Popular Job Shop Plating Processes (Size Adjusted)

Process	Usage
Sulfamate Ni	33.6%
Watts Ni	32.6%
Acid Cu	29.7%
Acid Sn	29.5%
Hard Cr	27.4%
Electroless Ni	27.2%
Dec Cr (+6)	25.5%
Cyanide Cu	25.5%
Acid Zn	23.0%
Gold	21.9%

Table 28 Ten Most Popular Captive Shop Plating Processes

Process	Usage
Sulfamate Ni	23.7%
Watts Ni	23.0%
Gold	20.7%
Acid Cu	17.0%
Silver	16.3%
Cyanide Cu	15.6%
Dec Cr (+6)	14.1%
Acid Zn	12.6%
Dec Cr (+3)	11.9%
Hard Cr	9.6%

Tables 28 and 29 list the ten most popular plating processes in captive shops. Once again nickel plating processes top the list followed by gold. When size is taken into account, decorative chromium (+6) places second with gold third. Acid copper is next in either case.

Generally speaking job shops tend to have a broader usage of processes. In comparing the top ten listings for captive and job shops the lists are very much alike with a few exceptions. Electroless nickel and acid tin do not appear on the list for captive shops while silver and decorative chromium (+3) do not appear for job shops.

As regards to the overall use of proprietary chemical formulations, captive shops are slightly more likely than job shops to use them.

Table 29 Ten Most Popular Captive Shop Plating Processes (Size Adjusted)

Process	Usage
Watts Ni	32.6%
Dec Cr (+6)	27.5%
Gold	24.2%
Acid Cu	21.9%
Cyanide Cu	20.4%
Sulfamate Ni	20.0%
Acid Zn	18.8%
Hard Cr	17.4%
Dec Cr (+3)	17.4%
Silver	13.6%

Proprietary Chemical Sales

Respondents who purchase proprietary chemicals/additives were asked to estimate their annual cost for the top five processes they used. The responses obtained from 277 captive and job shops were used to calculate the average expenditure per shop in dollars. These values are reported in Tables 30 to 33 along with estimated total expenditures for all shops. These values were determined by calculating the expenditure for each process for the responding shops (number of shops times the average expenditure per shop) and then extending this to the total number of shops (8,223) in the original mailing list. The processes are ranked by dollar volume in each table. Since only the top five processes were to be reported by each respondent, the figures are likely to be higher than actual average usage.

Table 30 Annual Sales of Proprietary Plating Chemicals

Process	Average, $	Total, $ Millions
Gold	82,400	134
Watts Ni	36,700	75
Acid Zn	53,100	74
Sulfamate Ni	37,000	69
Dec Cr (+6)	41,700	58
Hard Cr	42,700	47
Dec Cr (+3)	41,900	36

Table 31 Annual Sales of Proprietary Plating Chemicals

Process	Average, $	Total, $ Millions
Silver	29,600	34
Acid Cu	22,100	31
Acid Sn	35,100	30
Cyanide Cu	17,900	26
Zinc Alloys	46,900	24
Alkaline Zn	37,300	20
Cadmium	23,900	18

Table 32 Annual Sales of Proprietary Plating Chemicals

Process	Average, $	Total, $ Millions
Sn-Pb	27,100	17
Brass	28,500	15
Alkaline Cu	11,300	11
Stannate	18,000	9
Cyanide Zn	17,300	8
Bronze	25,700	5

Anode Sales

Respondents were asked to estimate soluble anode usage for the top five processes they used. The responses are reported in Table 34. As with the proprietary chemical sales, average values are reported along with an extension to the total universe of shops in the U.S. As expected the highest dollar volume was for nickel anodes.

Table 33 Annual Average Sales of Proprietary Surface Treatments

Process	Average, $	Total, $ Millions
Pretreatment	47,100	208
Electroless Ni	67,500	130
Strippers	24,400	91
Chromates	18,900	49
Hardcoat	33,300	31
Anodizing	22,300	27
Electroless Cu	50,400	20
Electropolish	17,300	18

Table 34 Annual Sales of Anodes

Metal	Average, $	Total, $ Millions
Nickel	42,700	153
Zinc	40,000	95
Tin	32,400	45
Silver	45,100	43
Copper (Acid)	31,700	40
Copper (CN)	18,400	26
Solder	17,400	15
Cadmium	8,600	7

TECHNOLOGY TRENDS

Process Usage

The survey respondents were asked to project future growth/shrinkage regarding 34 plating and surface treatment processes. For each process the questionnaire offered the following check list: decrease substantially, decrease somewhat, stay the same, increase somewhat, or increase substantially over the next two years. In this section a growth index was defined by assigning a value of 300 for increase substantially, 200 for increase, and 100 for stay the same. Also, the data were also adjusted for size based on the number of employees, similar to the adjustment made in the Material Usage section above. The processes were again grouped as follows for reporting the results:

- Nickel and Chromium
- Cadmium and Zinc
- Copper and Alloys
- Gold, Silver, and Tin
- Surface Treatments

Nickel and Chromium

Figures 4 to 7 show the trends for chromium plating processes in job and captive finishing shops using the raw data and also size-adjusted figures. Respondents were asked whether the processes they used were expected to decrease substantially, decrease somewhat, stay the same, increase somewhat, or increase substantially (jump) over the next two years. Since there were few reports of substantial decreases, these were combined with decrease somewhat values for reporting purposes. The results indicate that while job shops expect all the chromium plating processes to increase, captive shops expect decreases. When the results are adjusted for size the decreases in captive shops are more pronounced. It appears that captive shops are reducing the usage of chromium plating in-house and outsourcing these processes to the job shops, thus transferring the related environmental risks.

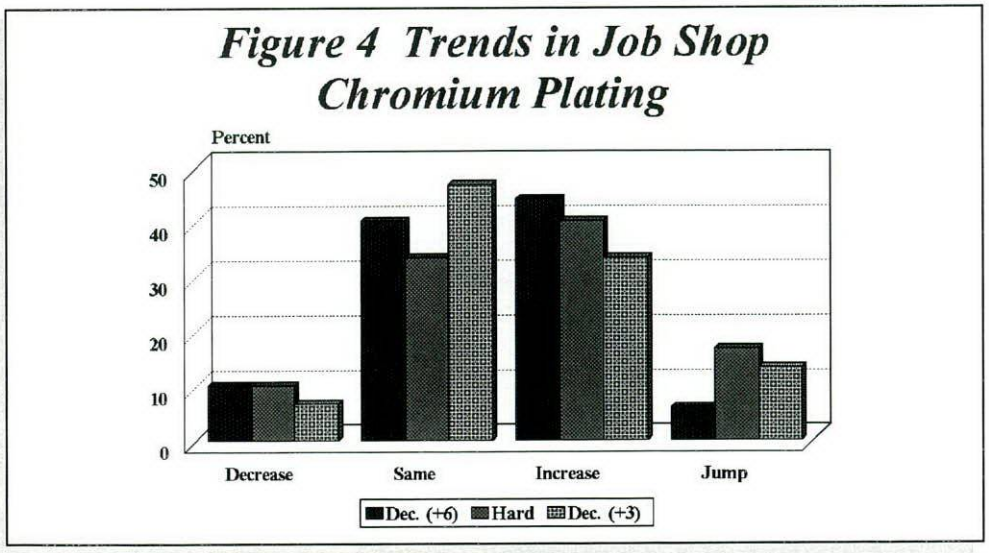


Figure 5 Trends in Job Shop Chromium Plating (Size Adjusted)

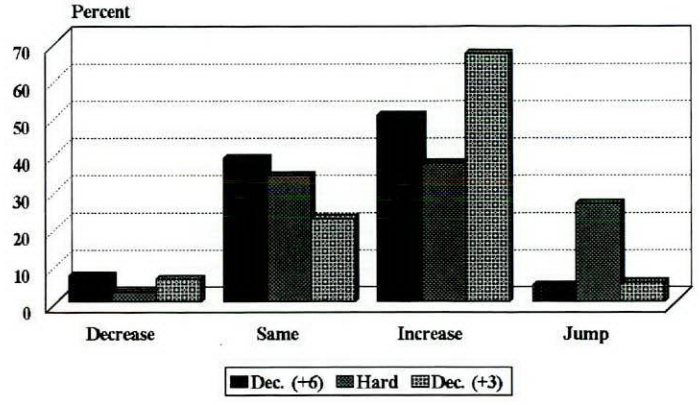
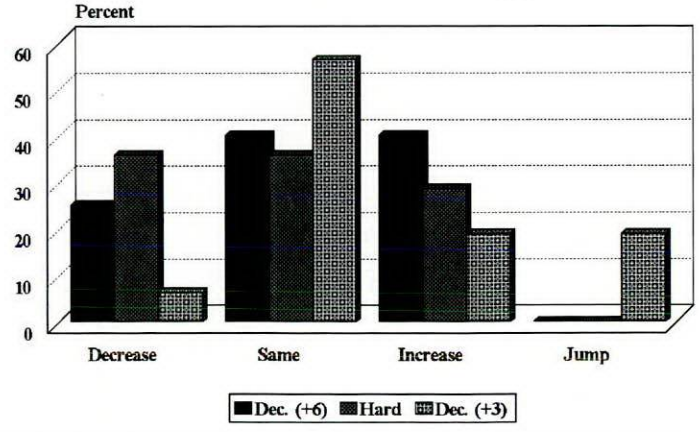
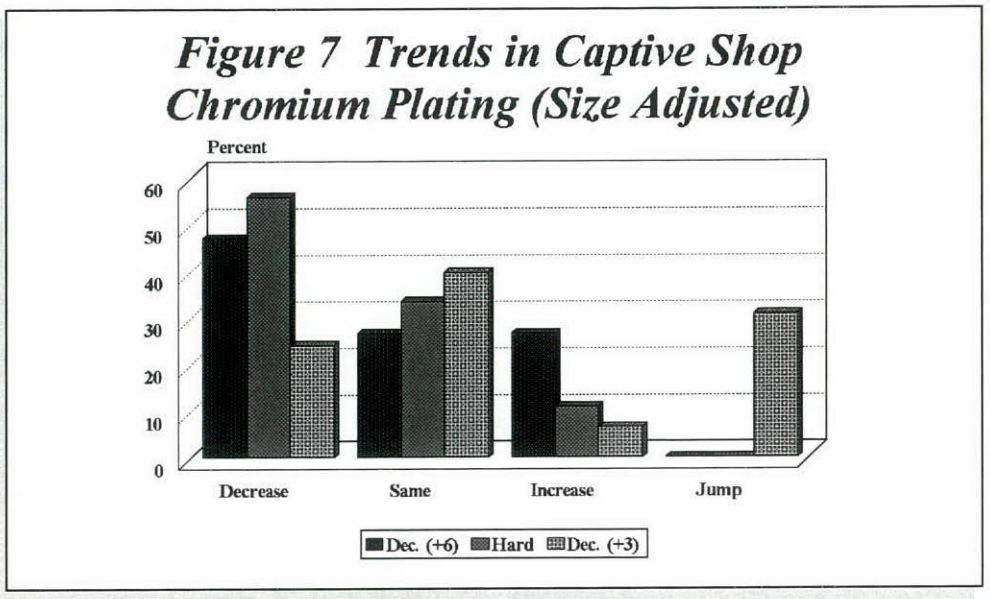


Figure 6 Trends in Captive Shop Chromium Plating





The trends for nickel plating are shown in Figures 8 to 11. Electroless nickel is expected to increase substantially by job shops while captive shops are less enthusiastic. There is little expectation for decreasing nickel plating in either captive or job shops.

Growth indexes (see definition above) for nickel and chromium plating are reported in Tables 35 and 36. Captive shops are definitely bearish about decorative chromium (+6) and hard chromium, especially on a size-weighted basis. On the other hand job shops are bullish, especially as regards hard chromium. Electroless nickel is expected to show the greatest growth among all these processes for job shops with sulfamate nickel having the best outlook for captive shops when considering shop size.

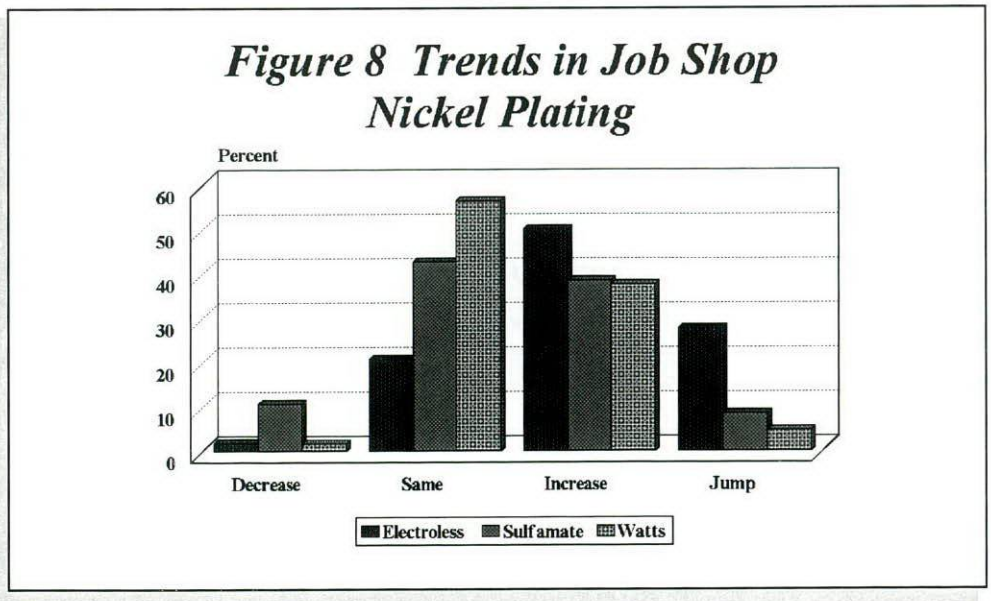


Figure 9 Trends in Job Shop Nickel Plating (Size Adjusted)

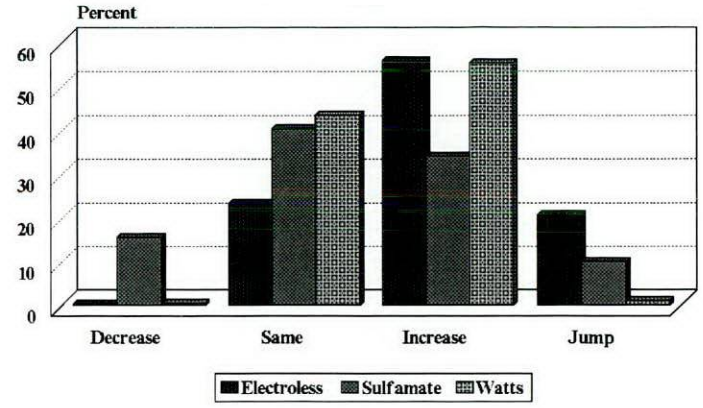


Figure 10 Trends in Captive Shop Nickel Plating

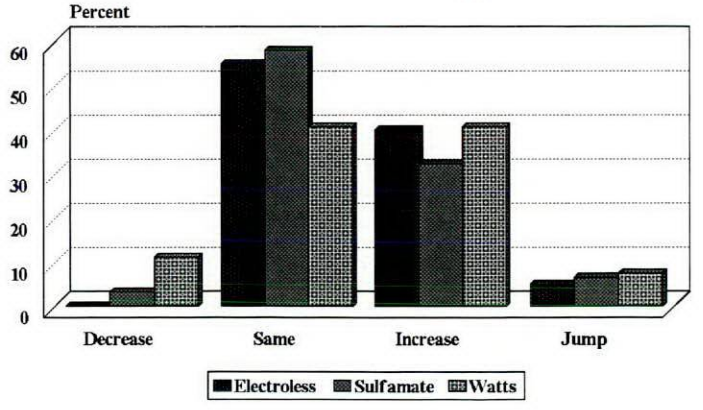


Figure 11 Trends in Captive Shop Nickel Plating (Size Adjusted)

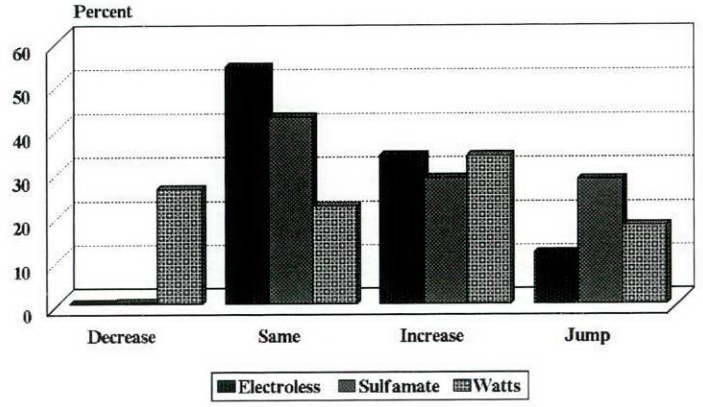


Table 35 Growth Indexes for Nickel and Chromium Plating

Process	Captive Shops	Job Shops
Dec. Cr (+6)	110	146
Hard Cr	93	163
Dec. Cr (+3)	150	153
Electroless Ni	150	203
Sulfamate Ni	142	145
Watts Ni	144	145

Table 36 Size-Adjusted Growth Indexes for Nickel and Chromium Plating

Process	Captive Shops	Job Shops
Dec. Cr (+6)	80	152
Hard Cr	55	188
Dec. Cr (+3)	143	171
Electroless Ni	156	197
Sulfamate Ni	184	138
Watts Ni	143	157

Cadmium and Zinc

Trends in job shop cadmium and cyanide zinc plating are presented in Figures 12 and 13. Prospects for both appear flat with the raw data indicating a decrease. Size-adjusted figures are up for the cyanide zinc and slightly up for cadmium. In contrast, prospects for noncyanide zinc plating are definitely bullish as seen in Figures 14 and 15. The zinc alloys include zinc-cobalt, zinc-iron, zinc-nickel, and tin-zinc.

Figure 12 Trends in Job Shop Cadmium and Cyanide Zinc Plating

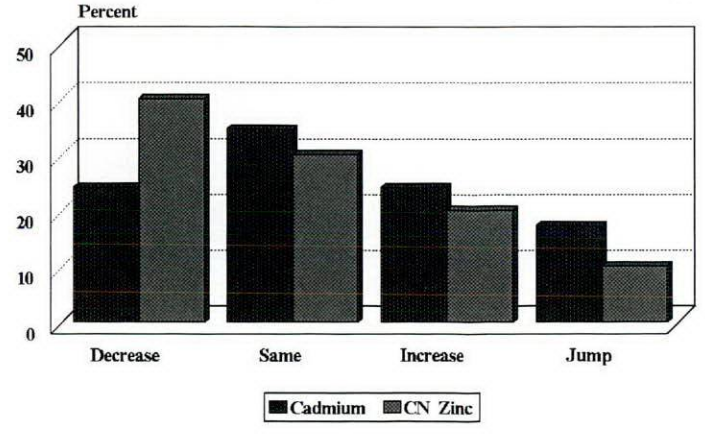


Figure 13 Size-Adjusted Trends in Job Shop Cadmium and Cyanide Zinc

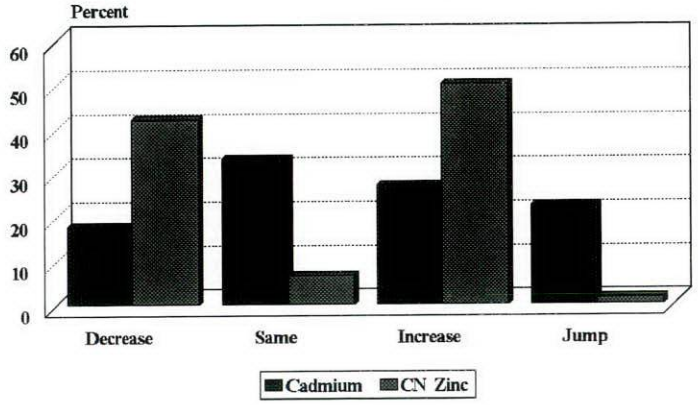
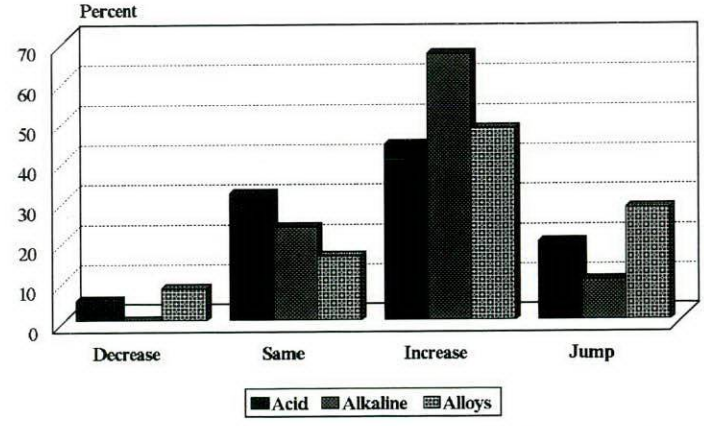
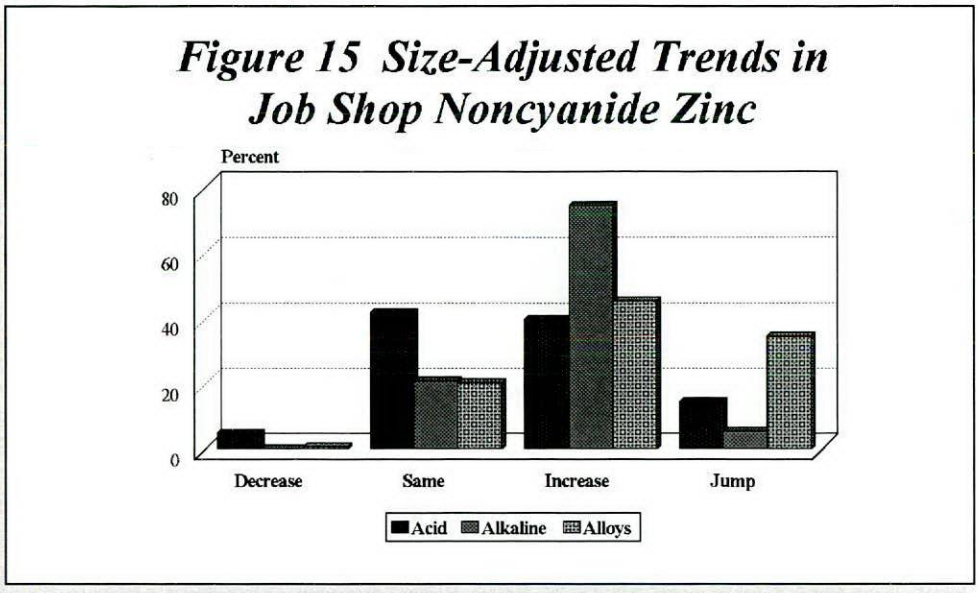


Figure 14 Trends in Job Shop Noncyanide Zinc Plating





Captive shop data are shown in Figures 16 and 17 for cadmium and cyanide zinc. Cadmium is strongly downward and cyanide zinc slightly positive in the raw data of Figure 16. Figure 17 indicates the size-adjusted trends for cadmium are very strongly negative while cyanide zinc is absolutely flat. Trends for noncyanide zinc plating in captive shops are shown in Figures 18 and 19. The general trend for all is upward but the size-adjusted data for acid zinc are wildly scattered.

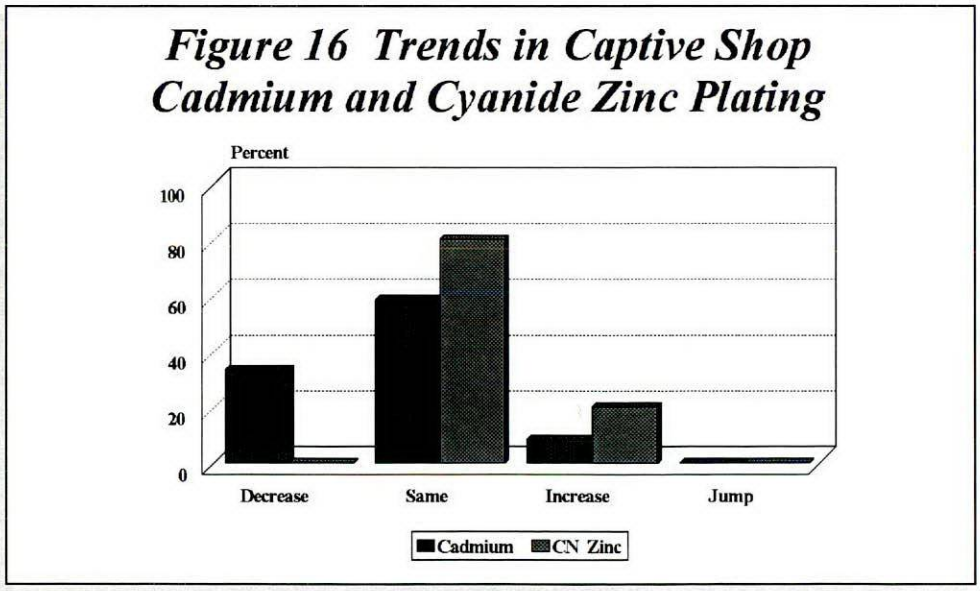


Figure 17 Size-Adjusted Trends in Captive Cadmium and Cyanide Zinc

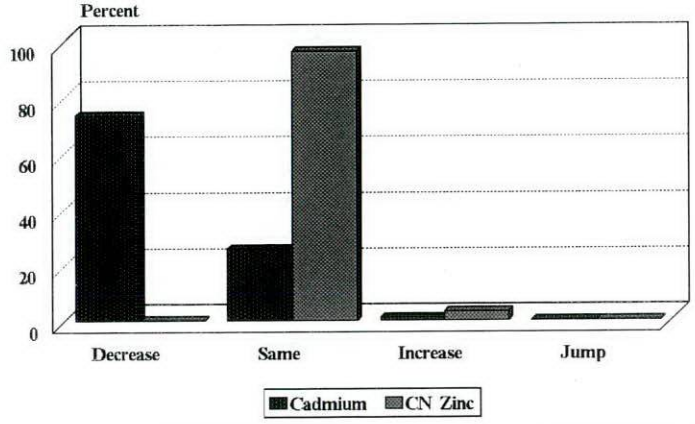


Figure 18 Trends in Captive Shop Noncyanide Zinc Plating

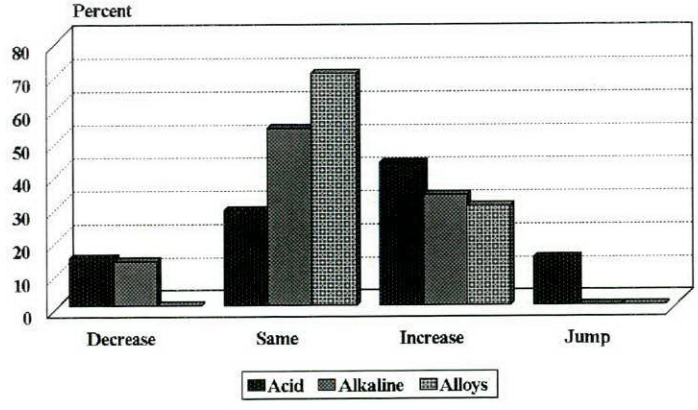
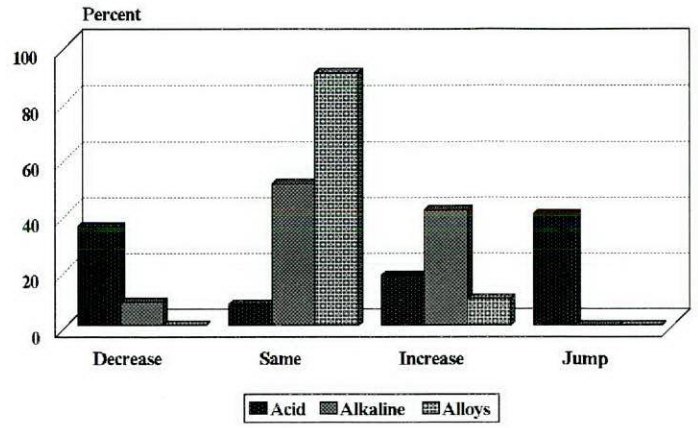


Figure 19 Size-Adjusted Trends in Captive Shop Noncyanide Zinc Plating



Tables 37 and 38 report the growth indexes (see definition above) for cadmium and zinc plating processes. Job shops expect all the cadmium and zinc processes to grow although there is less optimism for cadmium and cyanide zinc. When taking size into consideration, cyanide zinc is expected to be flat. Captive shops are bullish on all the zinc plating processes except cyanide, which is expected to be flat. For environmental reasons, cadmium is on the way out among the captive shops, especially when size is considered, with an index rating of only 27.

The expected increase of cadmium usage by job shops is likely to be due to the phasing out of the process by captive shops amid a continued trend toward outsourcing.

Table 37 Growth Indexes for Cadmium and Zinc Plating

Process	Captive Shops	Job Shops
Cadmium	75	134
Acid Zn	157	178
Alkaline Zn	120	187
Cyanide Zn	120	143
Zn Alloys	140	186

Table 38 Size-Adjusted Growth Indexes for Cadmium and Zinc Plating

Process	Captive Shops	Job Shops
Cadmium	27	154
Acid Zn	162	163
Alkaline Zn	133	185
Cyanide Zn	100	111
Zn Alloys	123	187

Copper and Copper Alloys

Expectations for copper plating in job shops are presented in Figures 20 and 21. The general trend is positive with acid and electroless copper the leaders. Figures 22 and 23 show the results for captive shops with electroless copper very positive and both acid and alkaline copper also positive. Trends for copper alloy (brass and bronze) plating in captive and job shops are provided in Figures 24 to 27. The results are quite interesting as captive shops generally show a positive outlook, especially when size in taken into account, while job shops are somewhat negative with shop size not a factor.

Figure 20 Trends in Job Shop Copper Plating

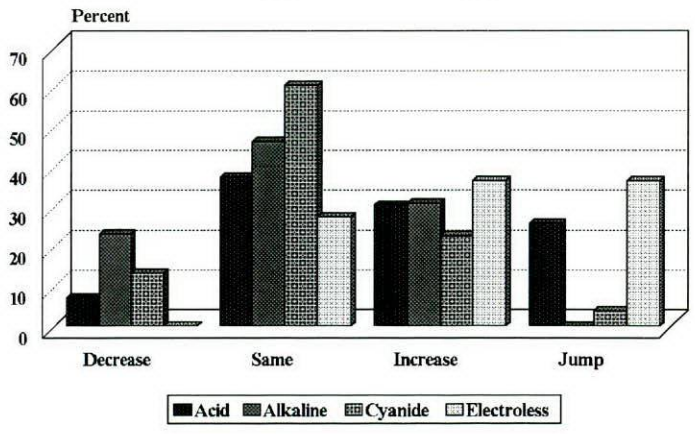


Figure 21 Size-Adjusted Trends in Job Shop Copper Plating

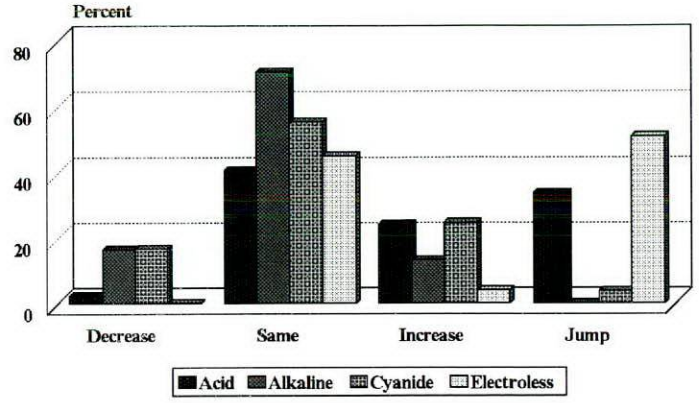


Figure 22 Trends in Captive Shop Copper Plating

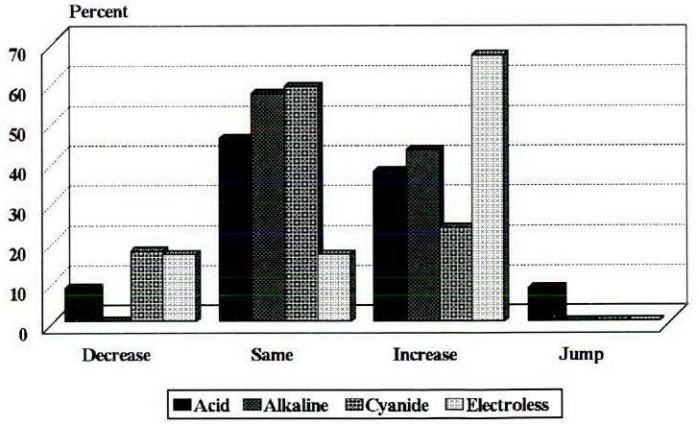


Figure 23 Size-Adjusted Trends in Captive Shop Copper Plating

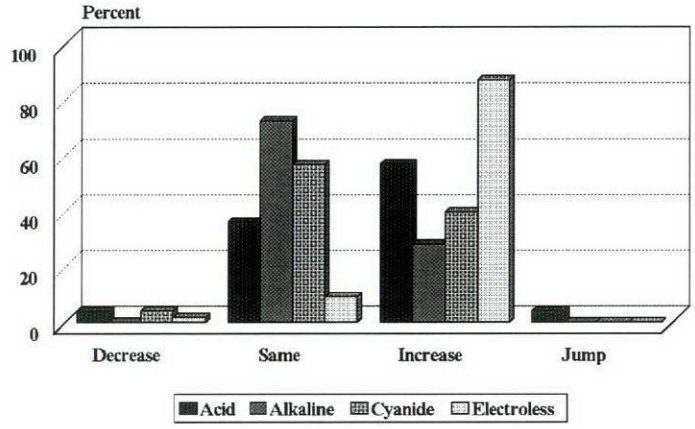


Figure 24 Trends in Job Shop Brass and Bronze Plating

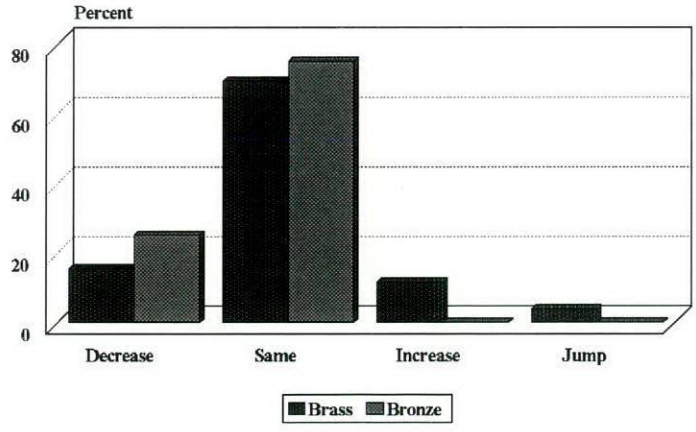


Figure 25 Size-Adjusted Trends in Job Shop Brass and Bronze Plating

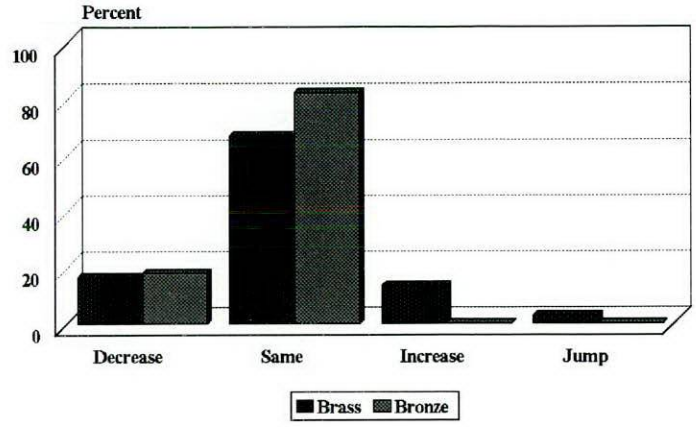


Figure 26 Trends in Captive Shop Brass and Bronze Plating

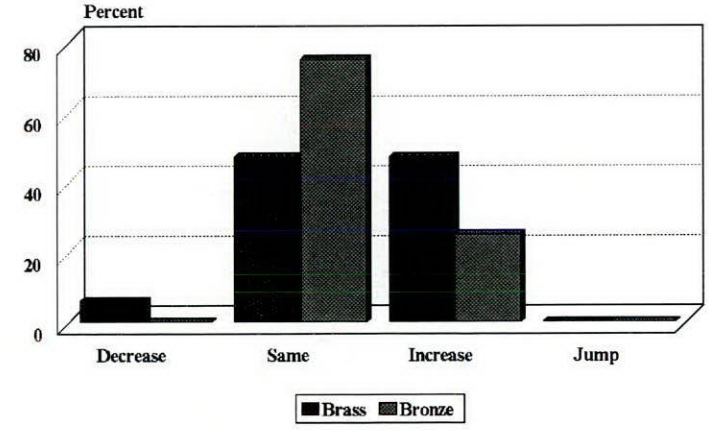
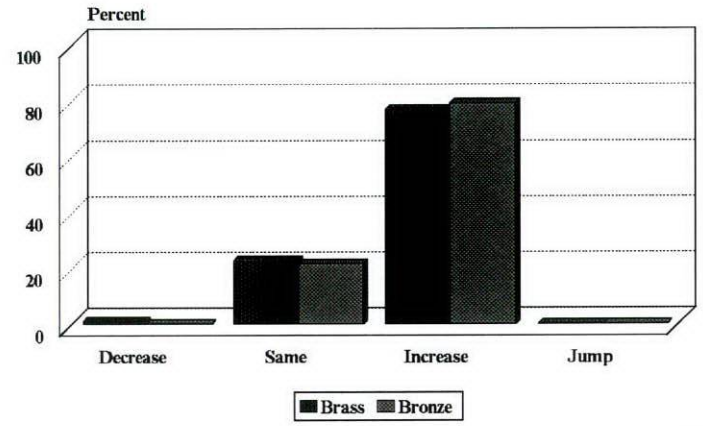


Figure 27 Size-Adjusted Trends in Captive Shop Brass and Bronze Plating



Growth indexes (see definition above) for copper and copper alloy plating are provided in Tables 39 and 40. Electroless copper is the growth king in this group for both captive and job shop finishers. Acid copper is also expected to show healthy growth in both captive and job shops. The story for brass and bronze is mixed, with captive shops expecting growth and job shops looking for the outcome to be flat for brass and worse for bronze. The future for both alkaline and cyanide copper is expected to be little or no growth when size is taken into account.

Table 39 Growth Indexes for Copper and Copper Alloy Plating

Process	Captive Shops	Job Shops
Brass	141	104
Bronze	125	75
Acid Cu	146	174
Alkaline Cu	143	108
Cyanide Cu	106	117
Electroless Cu	150	209

Table 40 Size-Adjusted Growth Indexes for Copper and Copper Alloy Plating

Process	Captive Shops	Job Shops
Brass	176	102
Bronze	180	83
Acid Cu	161	189
Alkaline Cu	125	96
Cyanide Cu	135	115
Electroless Cu	183	206

Gold, Silver, and Tin

Trends in job shop precious metal plating are shown in Figures 28 and 29. The outlook for both gold and silver is bright. Figures 30 and 31 include results for captive shops. Gold is bright but silver is flat with increases offset by decreases. Tin and tin-lead trends are presented in Figures 32 to 35. All tin-related processes are expected to do well.

Figure 28 Trends in Job Shop Gold and Silver Plating

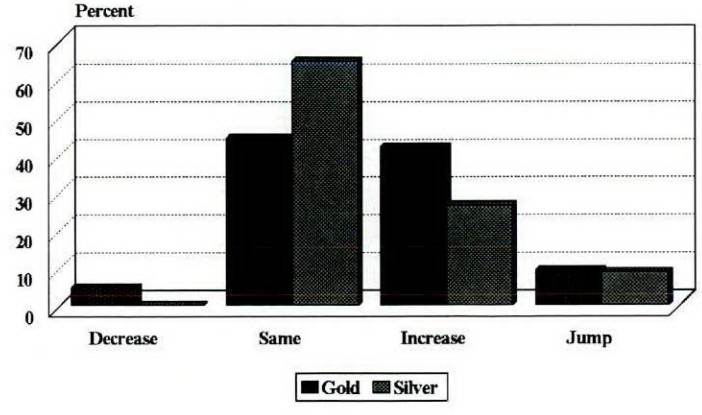


Figure 29 Size-Adjusted Trends in Job Shop Gold and Silver Plating

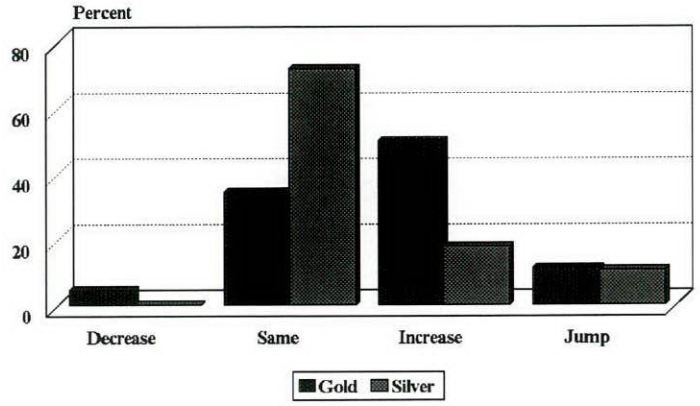


Figure 30 Trends in Captive Shop Gold and Silver Plating

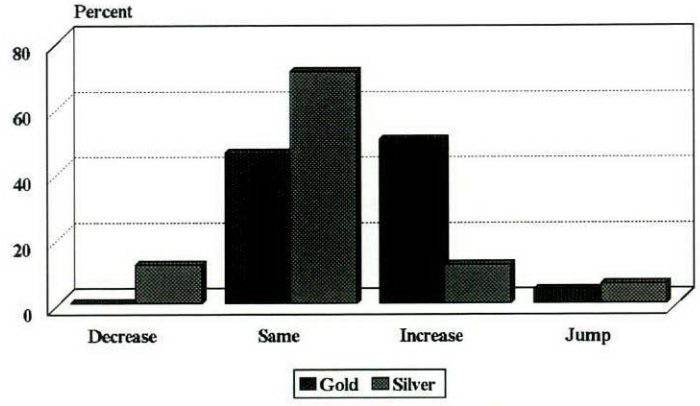


Figure 31 Size-Adjusted Trends in Captive Shop Gold and Silver Plating

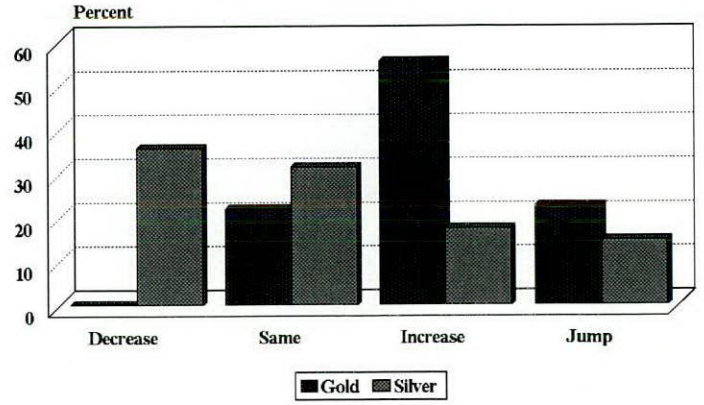


Figure 32 Trends in Job Shop Tin and Tin-Lead Plating

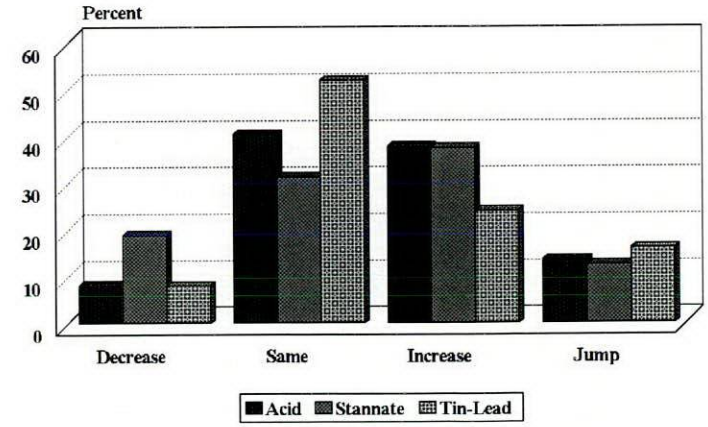


Figure 33 Size-Adjusted Trends in Job Shop Tin and Tin-Lead Plating

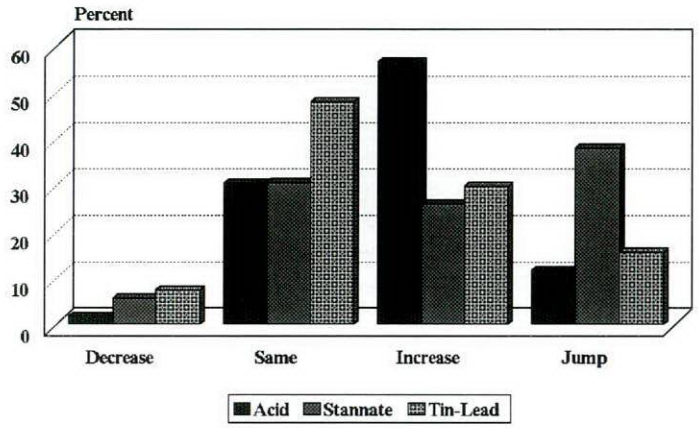


Figure 34 Trends in Captive Shop Tin and Tin-Lead Plating

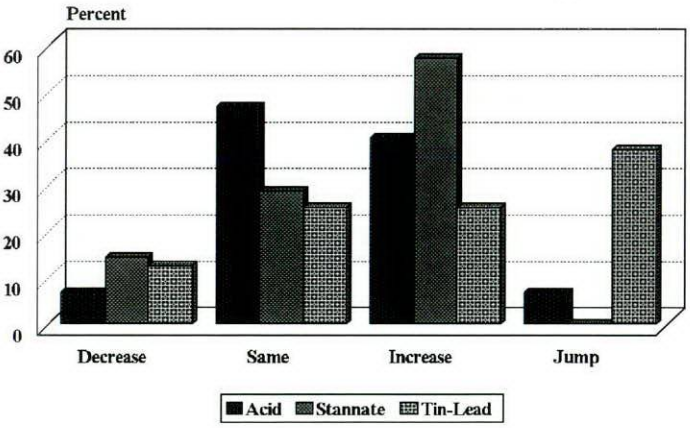
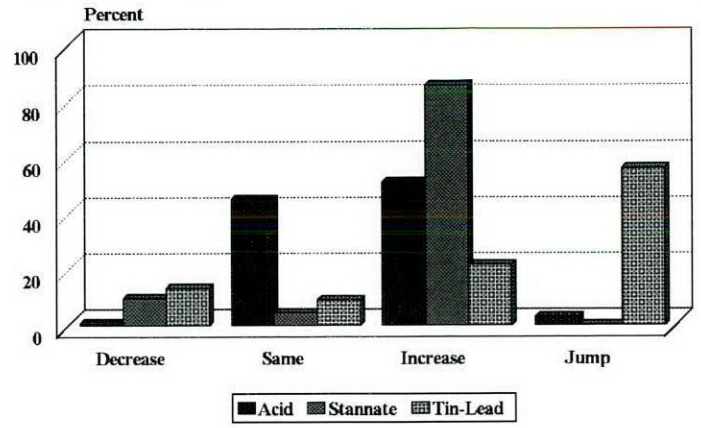


Figure 35 Size-Adjusted Trends in Captive Shop Tin and Tin-Lead Plating



Tables 41 and 42 give the growth indexes (see definition above) for gold, silver, and tin and tin-lead plating. Tin-lead leads growth expectations for captive shops and acid tin for job shops with gold next in line for both groups. Silver is relatively flat for the raw data but shows a little life when size is factored in. Stannate tin is very strong when size in accounted for.

Table 41 Growth Indexes for Gold, Silver, and Tin Plating

Process	Captive Shops	Job Shops
Gold	158	156
Silver	112	144
Acid Tin	147	157
Stannate	143	144
Tin-Lead	188	148

Table 42 Size-Adjusted Growth Indexes for Gold, Silver, and Tin Plating

Process	Captive Shops	Job Shops
Gold	200	168
Silver	110	139
Acid Tin	156	178
Stannate	176	196
Tin-Lead	220	154

Surface Treatments

Figures 36 to 39 present the outlook for anodic treatment processes (sulfuric acid anodizing, hardcoat anodizing, and electropolishing). All are expected to do well in both captive and job shops with the latter more enthusiastic. The results for chromate dips, pretreatments, and stripping are shown in Figures 40 to 43. Once again all are expected to do well with pretreatments especially cited by captive shops.

Figure 36 Trends in Job Shop Anodic Treatment Processes

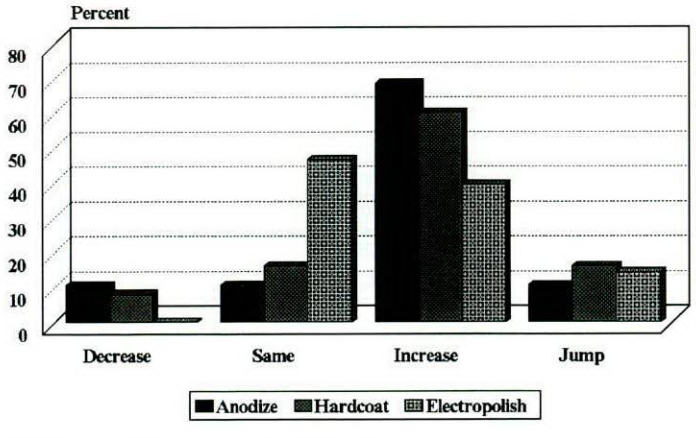


Figure 37 Size-Adjusted Trends in Job Shop Anodic Treatment Processes

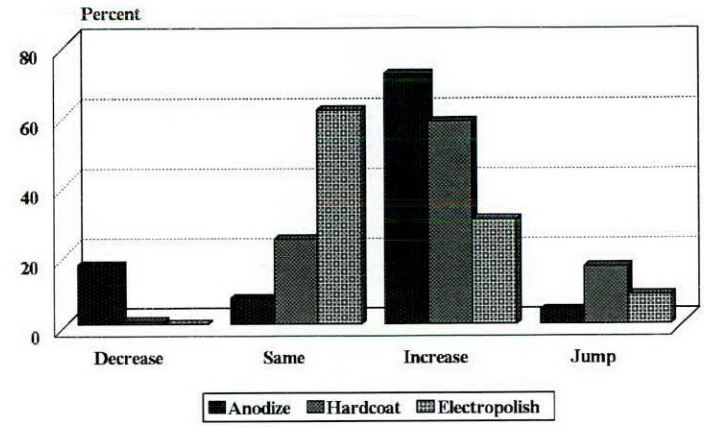


Figure 38 Trends in Captive Shop Anodic Treatment Processes

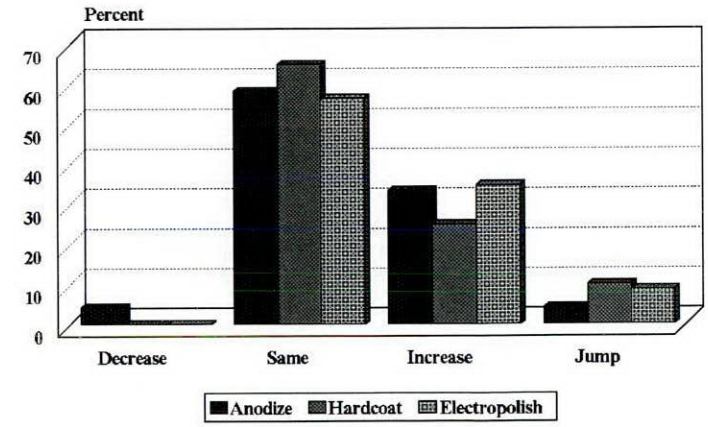


Figure 39 Size-Adjusted Trends in Captive Shop Anodic Treatments

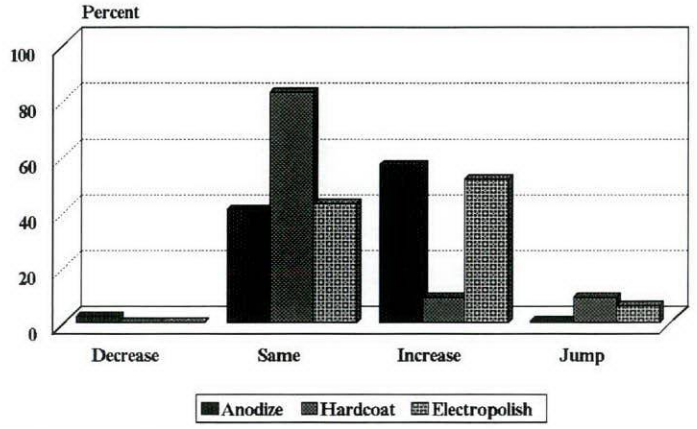


Figure 40 Trends in Job Shop Surface Treatments

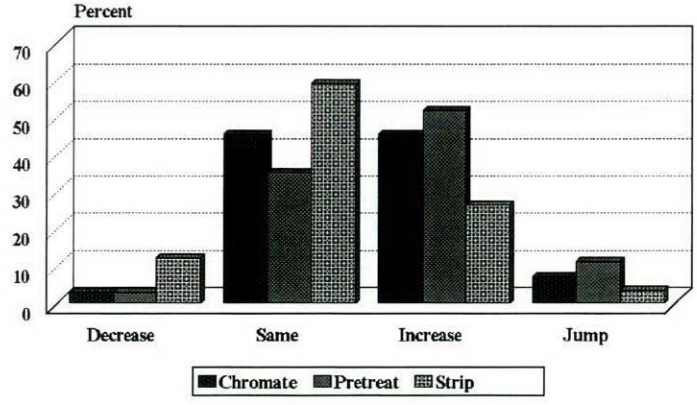


Figure 41 Size-Adjusted Trends in Job Shop Surface Treatments

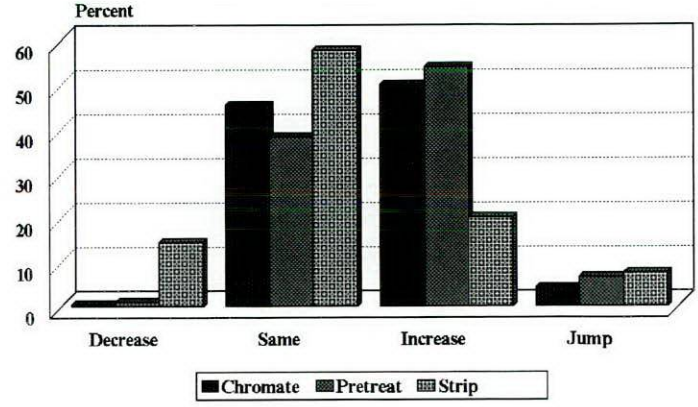


Figure 42 Trends in Captive Shop Surface Treatments

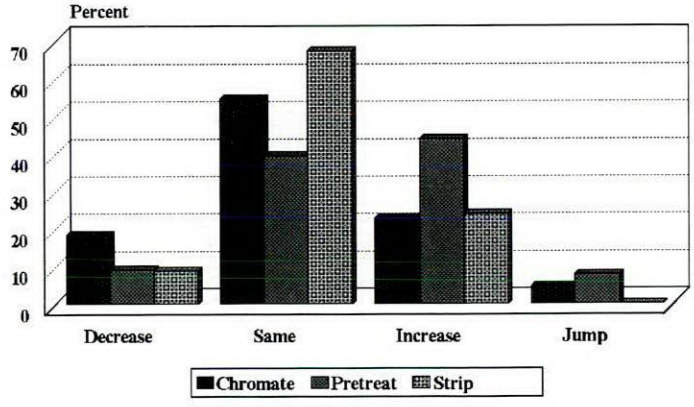
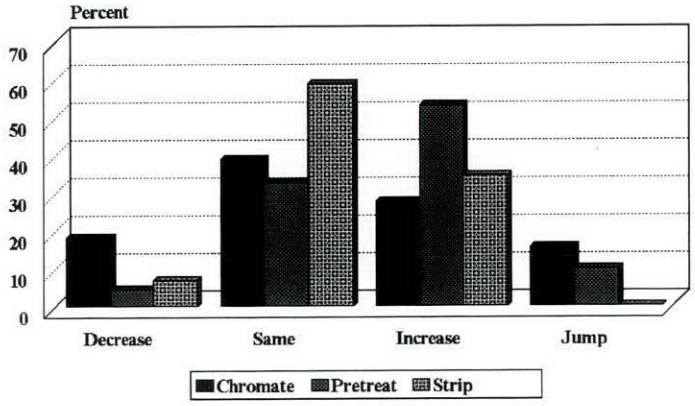


Figure 43 Size-Adjusted Trends in Captive Shop Surface Treatments



The growth indexes (see definition above) for several surface treatments used in captive and job shops are given in Tables 43 and 44. Electropolishing and pretreatment processes have the greatest prospects among the captive shops with anodizing and hardcoating leading the way for job shops. Stripping processes show the least expected growth.

Table 43 Growth Indexes for Surface Treatments

Process	Captive Shops	Job Shops
Anodizing	138	179
Hardcoat	145	184
Chromate	114	156
Electropolish	152	168
Pretreatment	150	171
Stripping	115	121

Table 44 Size-Adjusted Growth Indexes for Surface Treatments

Process	Captive Shops	Job Shops
Anodizing	154	163
Hardcoat	127	190
Chromate	140	158
Electropolish	163	147
Pretreatment	169	166
Stripping	128	121

Highest Growth Processes

Tables 45 and 46 report the top eight processes in growth index for job shops. Electroless copper and nickel top both the raw data and size-adjusted lists. Alkaline zinc, hardcoat, and zinc alloys are represented on both the raw data and size-adjusted top eight lists. The top eight growth processes for captive shops are listed in Tables 47 and 48. Tin-lead and gold top both the raw data and size-adjusted lists with electroless copper, acid zinc, electropolishing, and pretreatment the other processes to make both lists.

Table 45 Top 8 Job Shop Processes in Growth

Process	Index
Electroless Cu	209
Electroless Ni	201
Tin-Lead	188
Alkaline Zinc	187
Zinc Alloys	186
Hardcoat	184
Anodize	179
Acid Zinc	178

Table 46 Top 8 Job Shop Processes in Growth (Size Adjusted)

Process	Index
Electroless Cu	206
Electroless Ni	197
Stannate	196
Hardcoat	190
Acid Cu	189
Hard Cr	188
Zinc Alloys	187
Alkaline Zinc	185

Table 47 Top 8 Captive Shop Processes in Growth

Process	Index
Tin-Lead	188
Gold	158
Acid Zinc	157
Electropolish	157
Electroless Cu	150
Electroless Ni	150
Dec. Cr (+3)	150
Pretreatment	150

Table 48 Top 8 Captive Shop Processes in Growth (Size Adjusted)

Process	Index
Tin-Lead	220
Gold	200
Sulfamate Ni	184
Electroless Cu	183
Stannate	176
Pretreatment	169
Electropolish	163
Acid Zinc	162

Other Selected Processes

A number of processes with low current usage frequencies were not included above since the responses were expected to be small and not statistically valid. Interest in some of these processes; however, is strong so an attempt was made to at least gather some information on them, especially as regards trends for their future application. The processes studied included electroless gold, palladium and its alloys, rhodium, cobalt and its alloys, and tin-nickel. One additional process, chromic acid anodizing, was also included, but with the expectation that a reverse trend would be found. The results are presented in Figures 44 to 47.

Figure 44 Trends for Selected Precious Metal Processes

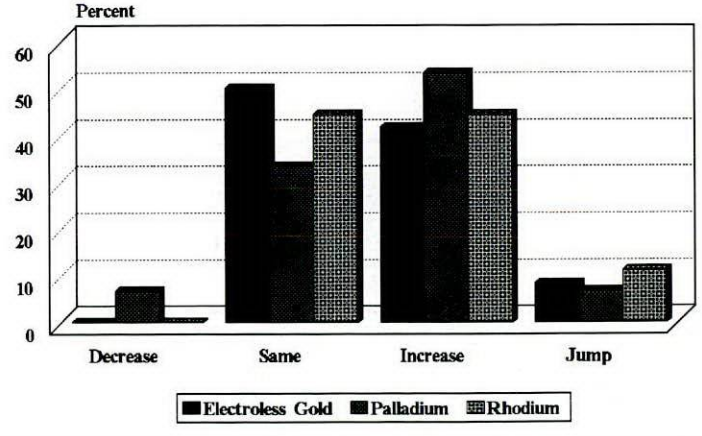


Figure 45 Size-Adjusted Trends for Selected Precious Metal Processes

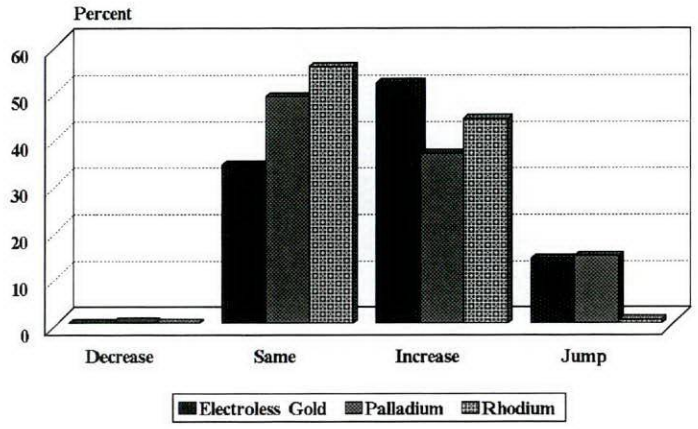


Figure 46 Trends for Selected Metal Finishing Processes

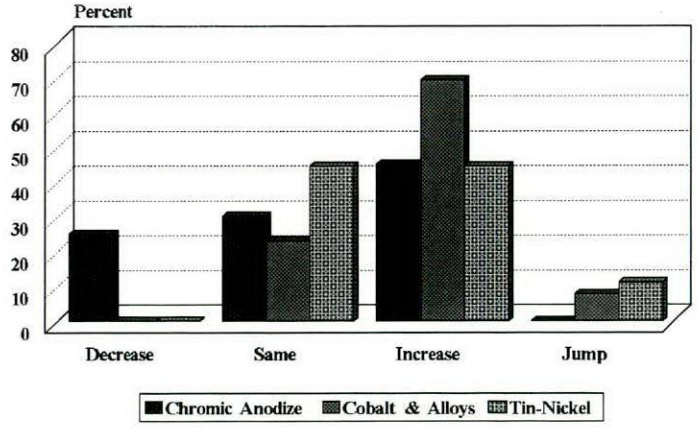
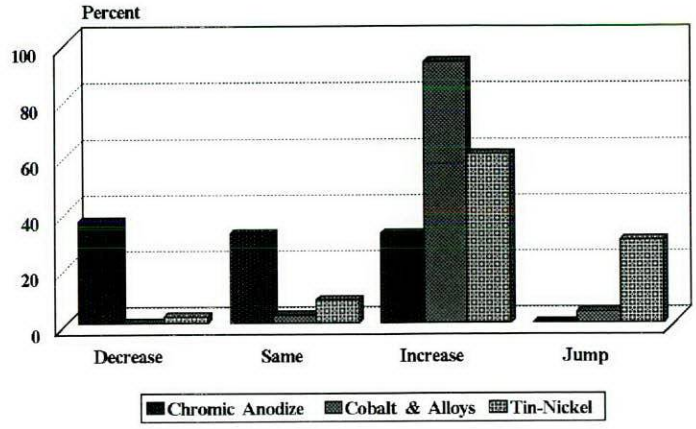


Figure 47 Size-Adjusted Trends for Selected Metal Finishing Processes



As expected, all these processes, with the exception of the chromic acid anodizing, show substantial patterns of expected growth. Due to the low number of responses, the data shown include results for a combination of captive and job shops. Growth indexes were calculated as well. These are presented in Tables 49 and 50. Cobalt and tin-nickel top both the raw data and size-adjusted listings. Chromic acid anodizing showed slight growth in the raw data but was flat when size was considered.

Table 49 Growth Indexes for Selected Metal Finishing Processes

Process	Index
Cobalt & Alloys	185
Tin-Nickel	172
Rhodium	167
Palladium	160
Electroless Gold	158
Chromic Anodize	120

Table 50 Size-Adjusted Growth Indexes for Selected Metal Finishing Processes

Process	Index
Tin-Nickel	217
Cobalt & Alloys	200
Electroless Gold	179
Palladium	165
Rhodium	146
Chromic Anodize	96

Process Eliminations

Respondents were asked to list any processes currently in use that they planned to eliminate within the next two years. There were 46 respondents (14% of survey respondents) who reported that they were eliminating a total of 52 process operations. The operations were categorized by the type of process and the results are summarized in Figure 48. By far the largest group of processes scheduled for elimination (44.2%) was the cyanide-based plating processes. A further breakdown of these cyanide operations is provided in Figure 49. The most frequently mentioned were cyanide copper and cyanide cadmium.

Figure 48 Processes to be Eliminated

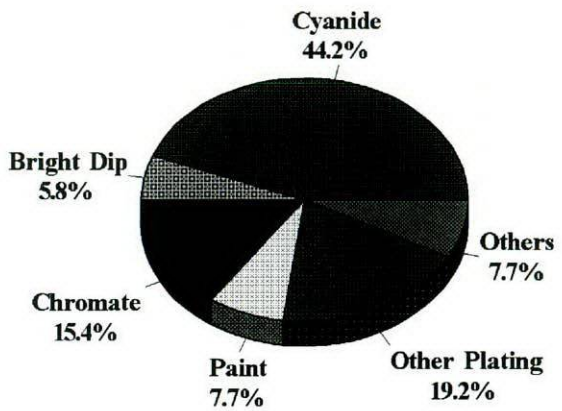
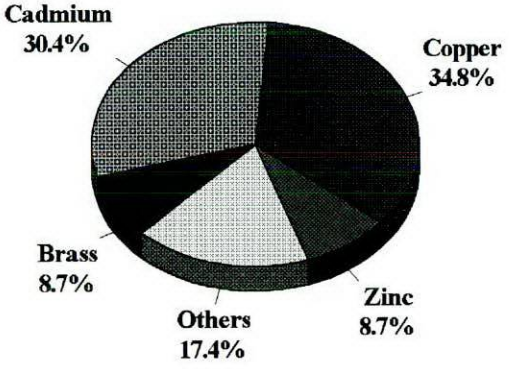


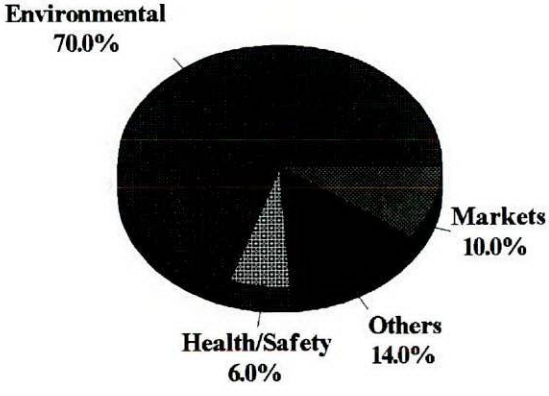
Figure 49 Cyanide-Based Processes to be Eliminated



Hexavalent chromium containing processes were scheduled for elimination by 15.4% of the respondents eliminating processes. The operations to be eliminated were about equally split between plating and chromate conversion coating processes. Other plating processes accounted for 19.2% of the operations to be eliminated. High VOC paints were to be eliminated by 7.7% and 5.8% mentioned nitric acid based bright dips.

The reasons for process elimination are summarized in Figure 50. Environmental and regulatory related concerns account for 70% of the replies. Changes in market conditions, such as loss of customer base, were mentioned by 10% of the respondents. There were 6% who mentioned health and safety considerations and several who planned plant closures and were included under other responses.

Figure 50 Reasons for Process Elimination



Process Additions

Respondents were also asked to list any new processes that they planned to install within the next two years. There were 79 respondents (24% of survey respondents) who reported plans to install 93 process operations, which is fairly optimistic. These operations were categorized by type and the results are summarized in Table 51. The largest new process type was electroplating with 39.8% of new responses. A further breakdown of the new electroplating processes is provided in Figure 51. The most frequently mentioned were zinc and copper and their alloys. Painting and powder coating were mentioned by 12.9% of new process respondents, electroless nickel and conversion coating processes were each mentioned by 10.8% of these respondents.

Eighty respondents provided the reasons for the new process installations. These are summarized in Figure 52. As expected, the largest category (42.5%) is response to customer requirements; however, environmental considerations also ranked high at 27.5% followed by quality control/productivity (16.3%).

Table 51 New Processes to be Installed

Process	Frequency
Electroplating	39.8%
Paint/Powder	12.9%
Electroless Nickel	10.8%
Conversion Coating	10.8%
Cleaning	7.5%
Anodizing	6.5%
Electropolishing	4.3%
Others	7.5%

Basis: 93 new process installations

Figure 51 New Electroplating Processes to be Installed

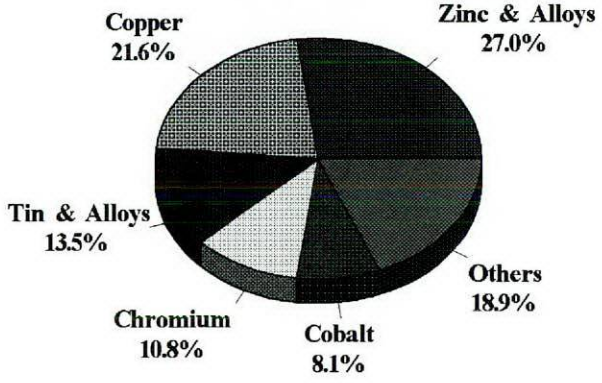
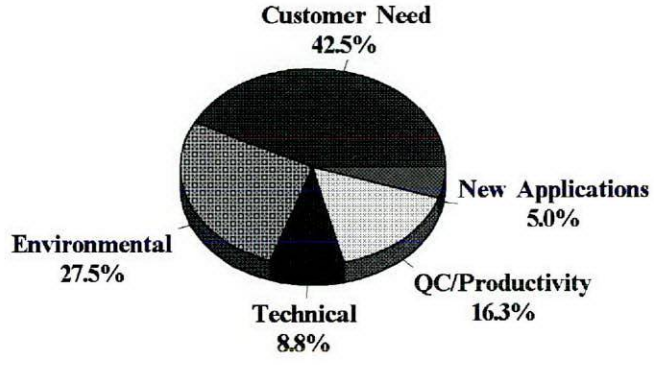


Figure 52 Reasons for New Process Installations



Basis: 80 replies

SUBSTRATES

Current Usage

Table 52 lists the percentage of respondents who use a particular substrate listed in order of frequency. The total adds up to more than 100% since most shops handle several different substrates. The data represent both captive and job shop responses combined. More than half of the finishers responding process low carbon, high carbon, and stainless steels. Half process aluminum or aluminum alloys and just under half handle copper/brass/bronze. The data in Table 53 were adjusted to account for shop size based on the number of employees. Although several percentages changed, there was no substantial change in the rankings.

Table 52 Substrates Handled by Captive and Job Shop Finishers

Substrate	Usage
Low Carbon Steel	69.3%
High Carbon Steel	57.4%
Stainless Steel	54.5%
Aluminum & Alloys	49.5%
Copper/Brass/Bronze	45.1%
Nickel & Alloys	34.3%
Cast Iron	29.2%
Zinc & White Metal	28.2%
Titanium & Alloys	17.0%
Plastics	16.6%
Ceramics/Glass	10.5%
Circuit Boards	9.7%
Magnesium	9.4%

Basis: 277 responses

Table 53 Substrates Handled by Finishers (Size Adjusted)

Substrate	Usage
Low Carbon Steel	70.2%
High Carbon Steel	55.0%
Stainless Steel	46.5%
Aluminum & Alloys	45.8%
Copper/Brass/Bronze	43.0%
Cast Iron	28.1%
Zinc & White Metals	27.7%
Nickel & Alloys	27.4%
Plastics	17.0%
Titanium & Alloys	16.0%
Magnesium	10.0%
Circuit Boards	8.2%
Ceramics/Glass	6.8%

Basis: 277 responses

Future Trends

Respondents were asked to indicate whether the substrates they handled were expected to drop off in use, remain the same, increase, or increase substantially (jump) in the next two years. The results from 277 captive and job shop replies are summarized in Figures 53 to 60. Figures 53 and 54 give the expectations for ferrous-based substrates. All show some growth with cast iron the least positive, especially when size of shop is taken into account. Results for light metal substrates are presented in Figures 55 and 56. Aluminum, magnesium, and tungsten and their alloys all show good expectations of growth with size not a factor. Figures 57 and 58 present data for copper-based, nickel-based, and zinc and white metal substrates. All show the same levels of growth with size again not a factor. Trends for nonmetallic substrates are given in Figures 59 and 60. All indicate good growth prospects with size of minor consequence. An index of substrate growth trends was calculated by assigning a value of 300 for respondents who expected usage to increase substantially, 200 for those whom expected somewhat of an increase, and 100 for those expecting usage to remain the same.

Figure 53 Trends in Ferrous Metal Substrates Handled

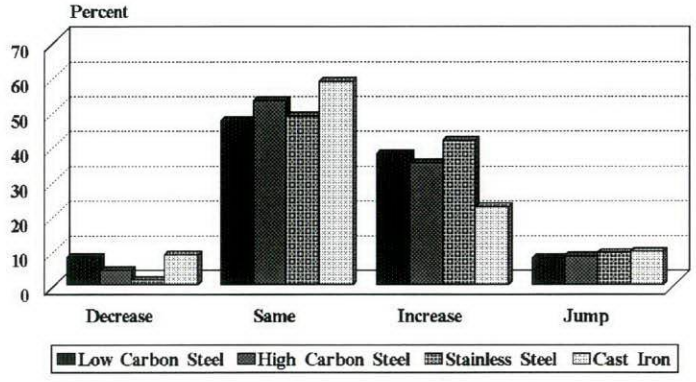


Figure 54 Size-Adjusted Trends in Ferrous Metal Substrates Handled

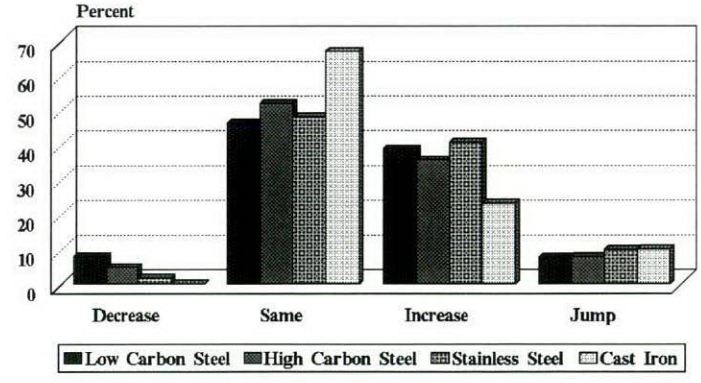


Figure 55 Trends in Light Metal Substrates Handled

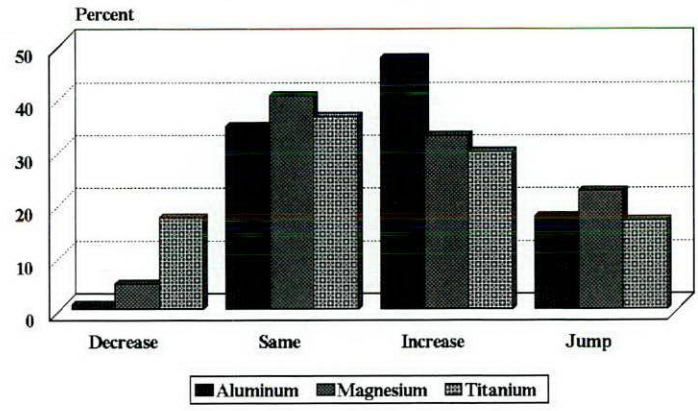


Figure 56 Size-Adjusted Trends in Light Metal Substrates Handled

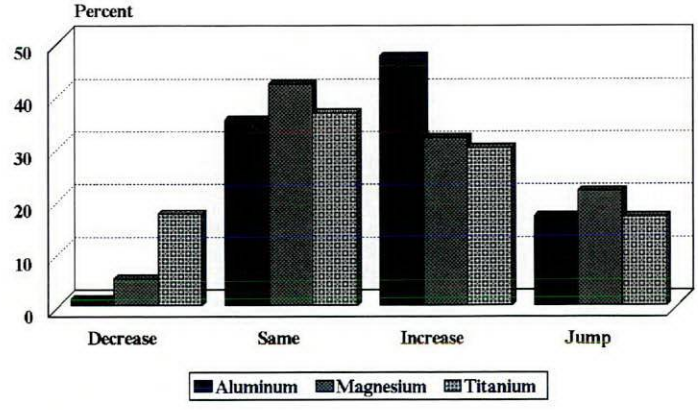


Figure 57 Trends in Other Metal and Alloy Substrates Handled

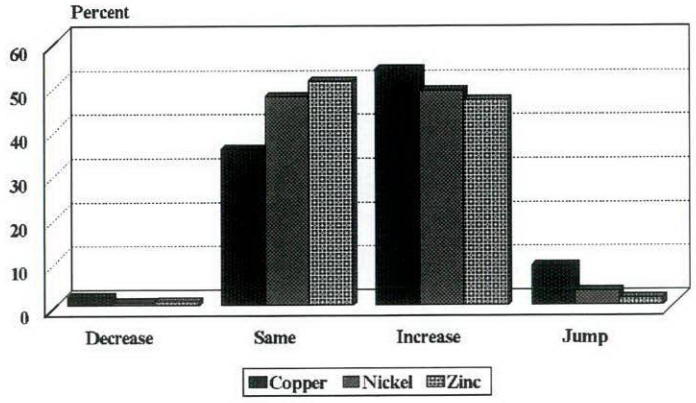


Figure 58 Size-Adjusted Trends in Other Metal and Alloy Substrates

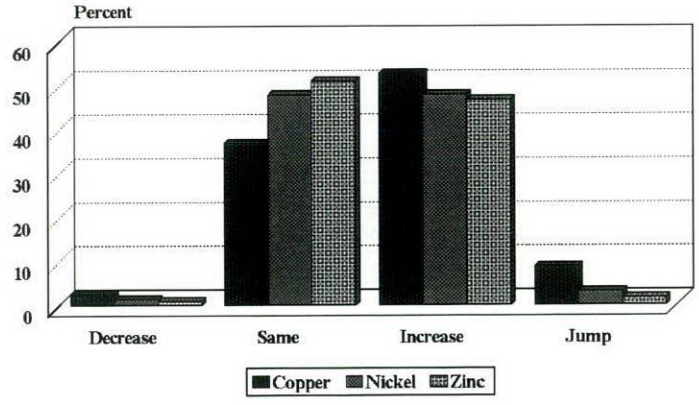


Figure 59 Trends in Nonmetallic Substrates Handled

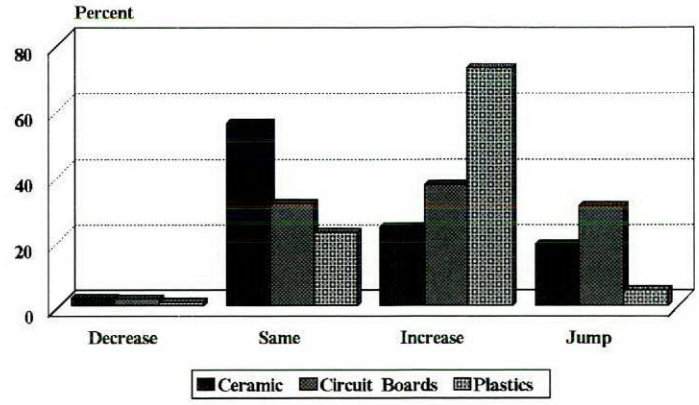


Figure 60 Size-Adjusted Trends in Nonmetallic Substrates Handled

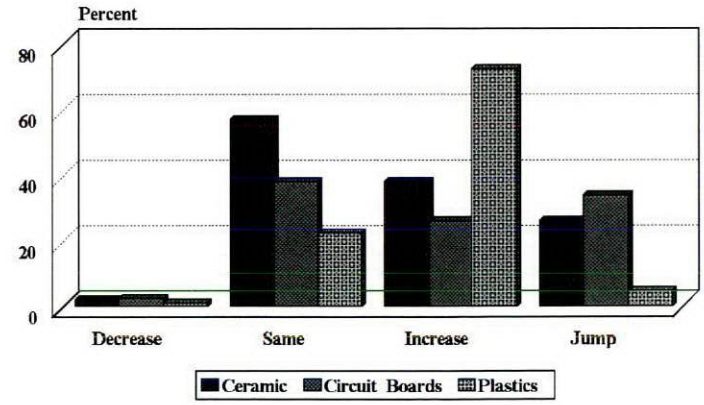


Table 54 lists the growth indexes for substrates handled and Table 55 provides a size-adjusted value for the substrate growth indexes. In each table the substrates are listed in rank order. Circuit boards ranked first followed by aluminum, plastics, and magnesium. The size adjustment of the data had very little affect.

Table 54 Growth Ratios for Substrates Handled

Substrate	Ratio
Circuit Boards	195
Aluminum & Alloys	182
Plastics	181
Magnesium & Alloys	173
Copper/Brass/Bronze	170
Ceramics/Glass	159
Stainless Steel	158
Nickel & Alloys	155
Zinc & White Metal	149
High Carbon Steel	147
Titanium & Alloys	146
Low Carbon Steel	145
Cast Iron	133

Basis: 277 responses

Table 55 Size-Adjusted Growth Ratios for Substrates Handled

Substrate	Ratio
Circuit Boards	191
Aluminum & Alloys	180
Plastics	178
Magnesium & Alloys	170
Copper/Brass/Bronze	168
Stainless Steel	158
Ceramics/Glass	156
Nickel & Alloys	153
Zinc & White Metal	150
High Carbon Steel	146
Low Carbon Steel	146
Titanium & Alloys	141
Cast Iron	132

Basis: 277 responses

ASSOCIATION MEMBERSHIP

Associations Involved

Table 56 shows the distribution of association membership from all survey responses by both job shops and captives. More than 40% are members of AESF and slightly more than 25% are members of NAMF. Both levels are lower than reported in last year's survey as shown in Table 57. More than 50% of job shops responding last year were AESF members and 40% were NAMF members. The captive shop respondents are more likely to be members of end user oriented manufacturing and/or testing organizations such as SME, ASTM, or SAE.

Table 56 Association Membership of Respondents

Organization	All	Job Shops	Captive Shops
AESF	42.2%	51.0%	22.2%
NAMF	26.6%	40.1%	7.4%
SME	19.9%	14.6%	24.4%
ASTM	18.7%	10.9%	32.6%
SAE	11.3%	7.8%	16.3%
ASM	8.9%	8.3%	9.6%

Table 57 Association Membership of Respondents 1997 vs. 1998

Organization	Fall 1997	Fall 1998
AESF	57.1%	42.2%
NAMF	45.8%	26.6%
SME	10.8%	19.9%
ASTM	11.0%	18.7%
SAE	9.0%	11.3%
ASM	8.8%	8.9%

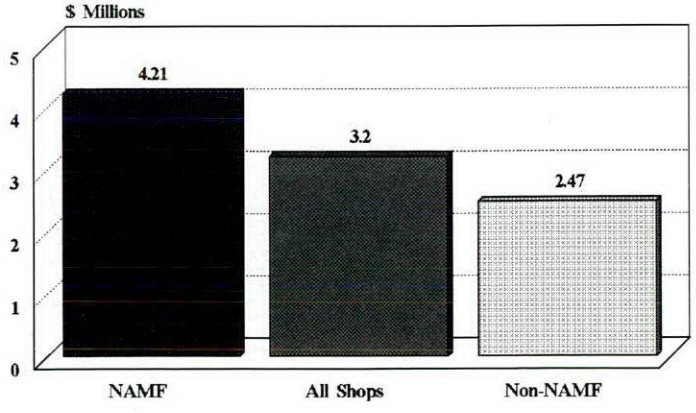
NAMF Member Comparison

SFMRB conducted an analysis of the annual sales levels of all responses relative to their membership in NAMF. The comparison of NAMF vs. non-NAMF member's is shown in Table 58 and Figure 61, where it is indicated that NAMF membership generally involves the larger job shops, with average sales of $4.21 million. The average sales of non-NAMF members are $2.47 million. These average sales values are about 12% above those reported last year.

Table 58 Comparison of Sales Volume of NAMF and Non-NAMF Shops

$ Millions	All Job Shops	NAMF Shops	Non-NAMF Shops
<0.25	11.6%	0.0%	20.2%
0.25-0.5	8.7%	4.1%	12.1%
0.5-1	18.6%	9.6%	25.2%
1-2	21.5%	28.8%	16.1%
2-3	7.6%	9.6%	6.1%
3-5	9.9%	15.1%	6.1%
5-7	9.9%	16.4%	5.1%
7-10	5.2%	8.2%	3.0%
10-15	4.1%	5.5%	3.0%
15-20	1.7%	2.7%	1.0%
>20	1.2%	0.0%	2.0%

Figure 61 Average Job Shop Sales Volume



AESF/NAMF Membership

Captive and job shop membership in AESF and NAMF is compared in Figures 62 and 63. It can be seen that 63% of job shops are members of one association or the other (or both) while only 32% of captives are members. These membership percentages are compared to last year's in Tables 59 and 60. Both groups show membership levels lower than reported in last year's survey.

Figure 62 Job Shop AESF/NAMF Membership

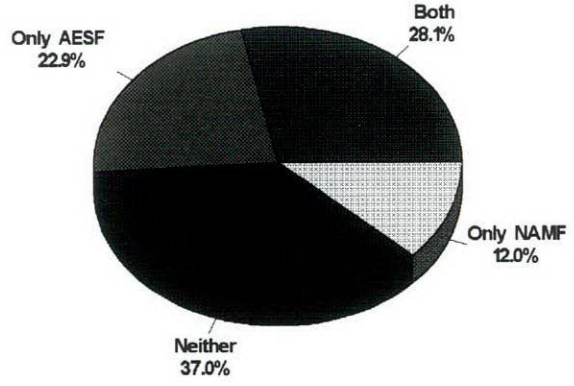


Figure 63 Captive Shop AESF/NAMF Membership

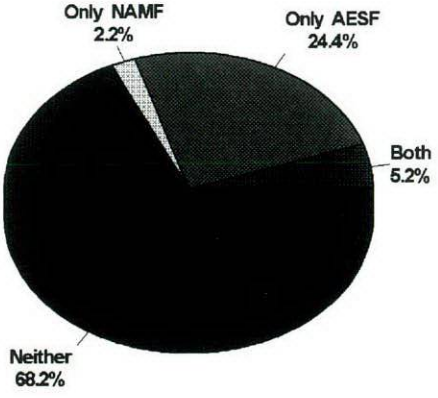


Table 59 Association Membership of Job Shops 1997 vs. 1998

	1997	1998
Both	40.7%	28.1%
Only AESF	18.7%	22.9%
Only NAMF	10.4%	12.0%
Neither	30.2%	37.0%

Table 60 Association Membership of Captive Shops 1997 vs. 1998

	1997	1998
Both	4.9%	5.2%
Only AESF	36.1%	24.4%
Only NAMF	1.6%	2.2%
Neither	57.4%	68.2%

SLUDGE DISPOSAL PRACTICES

Hazardous waste reduction is a key factor in the pollution prevention plans for metal finishers. An attempt was, therefore, made to estimate production of characteristic waste sludges produced by metal finishers. The most common material is designated F006. This is defined as "Wastewater treatment sludges from electroplating..." Table 61 summarizes the responses from 120 captive and 182 job shop operations regarding the annual production of F006 sludge.

Average annual production was 20.6 tons per year with captive shops reporting an average of 16.6 tons per year and job shops at 23.2 tons per year. These averages include the 35.8% of shops that produced no F006 sludge. Considering only the shops reporting F006 wastes, the figures would have been 28.8 tons per year for captive shops and 34.8 tons per year for job shops.

Those who produce F006 sludges were asked how they dispose of it. The answers are presented in Table 62 for 72 captive and 124 job shops. Approximately 40% of both groups send the sludge for recycling, about 42% send it to a hazardous waste landfill, and about 15% send a delisted sludge to a sanitary landfill. The balance of 3% use a combination of disposal methods.

Respondents were also asked to note any other listed hazardous wastes they produce. These results are given in Table 63. The most frequently mentioned (42 respondents) was D007, which includes chromium containing hazardous wastes. D002 (mentioned by 7 respondents) is a corrosive waste. D009 (mentioned by 5 respondents) is a mercury containing material. Eight other hazardous wastes were each mentioned by one or two respondents. These included:

D003	Reactive waste
D004	Arsenic
D005	Barium
D006	Cadmium
D008	Lead
F001	Spent halogenated solvents used in degreasing
F007	Spent cyanide plating bath solutions
F008	Plating bath residues (cyanide solutions)

There were 15 additional replies that did not specify a waste code. Of these 12 noted only an amount and 3 gave verbal descriptions that could not be classified with a waste code.

Table 61 F006 Sludge Disposal by Metal Finishers

Tons/year	Captive Shops	Job Shops	All Shops
None	41.7%	31.9%	35.8%
<5	25.8%	28.6%	27.5%
5-49	20.8%	25.8%	23.8%
50-99	9.2%	6.6%	7.6%
100-149	1.7%	4.9%	3.6%
150-199	0.8%	1.6%	1.3%
200-500	0.0%	0.5%	0.3%
>500	0.0%	0.0%	0.0%

Basis: 120 captive and 182 job shop replies

Table 62 F006 Sludge Disposal Procedures

Process	Captive Shops	Job Shops	All Shops
Recycle/Smelter	37.5%	41.1%	39.8%
Hazardous Landfill	41.7%	42.7%	42.3%
Sanitary Landfill (Delisted)	13.9%	15.3%	14.8%
Hazardous + Sanitary	2.8%	0.8%	1.5%
Recycle + Hazardous	4.2%	0.0%	1.5%

Basis: 72 captive and 124 job shop replies

Table 63 Generation of Other Listed Hazardous Wastes

Waste Code	# of Replies	Total Tons/year
D002	7	120
D007	42	280
D009	5	10.5

Note: 9 replies (111 tons/year) mentioned 8 other waste codes (1 or 2 each); 15 replies (201 tons/year) did not specify waste code

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METAL FINISHING INDUSTRY MARKET SURVEY

REPORT NO. 6

Resource Recovery, Capital and Material Expenditures and Wages and Benefits

MOVING FORWARD TOGETHER
SFMRB
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METAL FINISHING INDUSTRY MARKET SURVEY

REPORT NO. 6

Resource Recovery, Capital and Material Expenditures and Wages and Benefits

This report is published under the auspices of the Surface Finishing Industry Council (SFIC) by the American Electroplaters and Surface Finishers Society (AESF), the Metal Finishing Suppliers' Association (MFSA), and the National Association of Metal Finishers (NAMF) as a service to the metal finishing industry and contains information based on input from companies in the industry. The information published in this report was developed from actual historical information and does not include any quantitative projected information.

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EXECUTIVE SUMMARY

In recognition of the need for statistical information on the metal finishing industry and under the auspices of the Surface Finishing Industry Council (SFIC), the American Electroplaters and Surface Finishers Society (AESF), the Metal Finishing Suppliers' Association (MFSA), and the National Association of Metal Finishers (NAMF) jointly support the Surface Finishing Market Research Board (SFMRB). The board is composed of representatives of the sponsoring organizations, who meet to discuss methods to gather the data of interest, implement these methods, and then compile and report results.

This report is the sixth in a series. The initial report was completed in 1994, with subsequent reports published in 1995, 1997, 1998, and 1999. This report confirms and updates some of the previous data and also provides new information on salary and benefits, customer profiles, and fire prevention.

Some of the key findings, which are further detailed in the text, tables, and figures of the report, are as follows:

- Captive shops planned major capital expenditures for 2001 are expected to be much higher than job shops in most categories, with spending for material handling equipment especially higher than that of job shops.
- Watts nickel (based on nickel sulfate) is the most popular plating process for both captive and job shop finishers.
- The vast majority of job shops are non-union facilities.
- In general, captive shops offer higher wages than job shops for hourly employees.
- Employee benefits are higher for captive shops, with the exception of bonuses and use of company vehicles.
- Job shops have quickly adapted to promote their services on web sites.
- Resource recovery is an integral important part of today's electroplating production process.
- Zinc cyanide plating has been eliminated from a majority of plating shops nationwide.

Diskettes containing the data upon which this report is based (Microsoft Excel spreadsheet format) are available at an additional fee. SFMRB will also offer customized analyses and reports based on the data for a fee to be negotiated. (Minimum $500)

PURPOSE OF SFMRB

The metal finishing industry in North America has been faced with dramatic economic, technical, and regulatory challenges in recent decades. An industry under diverse pressures needs basic statistical information to know where it stands and to guide its future course. The Surface Finishing Market Research Board (SFMRB) was created in 1991 to meet this need.

SFMRB is managed by the Surface Finishing Industry Council (SFIC), which is funded and supported by the American Electroplaters and Surface Finishers Society (AESF), the Metal Finishing Suppliers' Association (MFSA), and the National Association of Metal Finishers (NAMF). The first two SFMRB reports, completed in 1993 and 1995, focused mainly on the status of the metal finishing industry. The third, fourth and fifth SFMRB reports, completed in 1997,1998, and 1999 also reported on the industry status, but in addition included data on ten areas of high interest to the sponsoring members.

The information in these reports is intended to help both metal finishers and their suppliers make better decisions regarding areas for business development and provide the industry with more detailed information regarding employment and commercial activity for use in presentation to governmental and regulatory bodies. This year's survey revisited some of the topics surveyed in the past, and ,where practical, compares the current data with that collected in prior surveys. We have also included some new data on customer profiles, wages and benefits, and fire prevention.

METHODOLOGY

The SFMRB used a mailing list supplied by an industry trade publication (*Metal Finishing*). The list was provided without rental charge. A random selection was made from the list, which consisted of only captive and job shop metal finishers in the United States who conducted operations concerned in the survey questions. The questionnaires were designed to be anonymous, brief, and easy to fill out. Each questionnaire was sent with a covering letter and a dollar bill to further encourage participation.

SURVEY RESPONSE

This survey was mailed in the fall of 2000 and was sent to 2,000 U.S. captive and job shops believed to be engaged in plating, anodizing, and electropolishing operations. It posed questions related to areas of interest to both finishers and suppliers, including sales volume, employment, planned expenditures, material usage and costs, employee benefits, pay rates, customer profiles, resource recovery techniques employed, and process substitutions.

The response rate from both surveys is summarized in Table 1. The rate of response rate was very good. A comparison with past surveys, by type of shop responding, is shown in Table 2. The total response was better than 1998 and the response from captive shops and job shops was comparable. Considering the quality and quantity of the responses, SFMRB believes the values currently reported to be plus or minus 5 to 10% of reality.

Table 1. Survey Responses

	Fall 1997	Fall 1998	Fall 2000
List Size	7,938	8,223	13,425
Number Mailed	2,000	2,000	2,000
Usable Returns	511	327	428
Response Rate	**25.5%**	**16.4%**	**21.8%**

Table 2. Comparison of Facility Types Responding to Surveys

Survey	Captive Shops	Job Shops
1992-1993	32%	68%
1993-1994	22%	78%
1996-1997	53.4%	46.6%
Fall 1997	11.9%	88.1%
Fall 1998	41.3%	58.7%
Fall 2000	**34.8%**	**65.2%**

BASIC INFORMATION

Business Orientation

The data are based on responses from 149 captive shops and 279 job shops. A captive shop provides metal finishing services within a manufacturing company, while a job shop provides metal finishing services for a fee. The U.S. EPA defines a captive shop as one that owns more than 50% of the product being finished in its facility.

Plant Locations

Tables 3 and 4 display all the responses broken down by percentage of job and captive plant sites for each of eight U.S. regional areas (see Figure 1) and compare them with the previous surveys. The distribution for job shop respondents (Table 3) compared favorably with the last survey. The captive shop distribution (Table 4) showed a larger number of plants located in the Western, East Central, and Mid-Atlantic regions and slightly fewer in the Southwest, West Central, and Southeast regions.

The survey confirms that the Midwest is the largest area for both captive and job shops, with roughly 40% of all finishers located in either the East or West Central regions. This is consistent with past SFMRB surveys.

Table 3. Job Shop Plant Locations

Region	Fall 1997	Fall 1998	Fall 2000
New England	10.4%	6.7%	9.5%
Mid-Atlantic	12.7%	13.5%	13.8%
Southeast	6.4%	7.3%	8.3%
East Central	20.5%	19.7%	19.0%
West Central	19.8%	23.0%	20.9%
Southwest	4.7%	6.7%	7.9%
West	21.4%	19.1%	17.4%
Northwest	4.0%	3.9%	3.2%

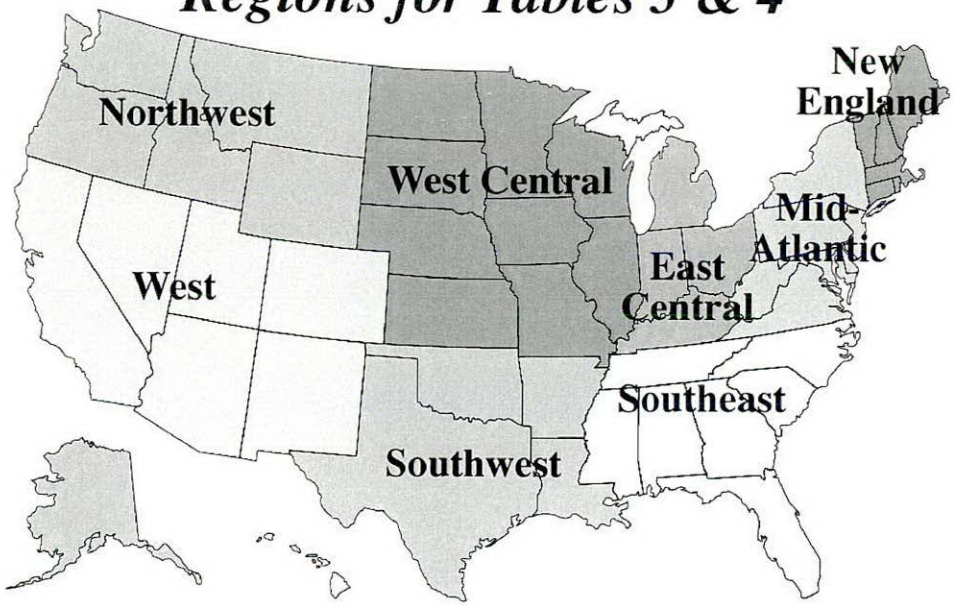
Basis: 253 replies in 2000

Table 4. Captive Shop Plant Locations

Region	Fall 1998	Fall 2000
New England	9.5%	11.0%
Mid-Atlantic	12.7%	15.9%
Southeast	18.2%	10.3%
East Central	15.9%	21.4%
West Central	19.0%	16.6%
Southwest	7.1%	4.8%
West	15.9%	18.6%
Northwest	0.8%	1.4%

Basis: 145 replies in 2000

Figure 1 Geographical Regions for Tables 3 & 4



Employment

Employment levels for captive and job shops are provided in Tables 5 and 6 by the percentage of companies in each of ten size categories. The data indicate a median of 17 and an average of 50 job shop employees per facility. This compares to a median of 20 and an average of 39 job shop employees in the 1998 survey.

There is a median of 20 and an average of 60 captive shop employees per facility. This compares to a median of 15 and an average of 42 captive employees in the 1998 survey. The median is taken as the number of employees for the shop in the middle of the range, for example the third shop in a ranked list of five; while the average is the sum of all employees for all shops divided by the number of shops. For example for this set of values:

<3 - 20%
3-5 - 30%
5-8 - 40%
>8 - 10%

The average = 1.5 x 0.2 + 4 x 0.3 + 6.5 x 0.4 + 9.5 x 0.1 = 5.05

Employee distribution for job shops in this survey is comparable with those of the 1998 survey, except for a substantially higher representation in the three categories above 75 employees. For captive shops, the below 20 employee categories are comparable with the past surveys, the mid ranges are mixed, and the highest range (above 200) is double. The low median values, relative to the averages, illustrate the large concentration of small U.S. metal finishers who have l0 or fewer employees. This year the survey range at the bottom (less than 5 employees) was widened to better account for the very small shops.

Table 5. Number of Job Shop Employees

Range	Fall 1997	Fall 1998	Fall 2000
1-2	*	*	4.7%
3-5	13.6%	16.1%	9.4%
6-10	14.7%	16.1%	14.4%
11-20	17.8%	18.2%	15.1%
21-30	12.7%	12.0%	10.8%
31-50	16.7%	14.1%	14.7%
51-75	9.4%	10.4%	9.4%
76-100	6.7%	4.7%	8.6%
101-200	7.5%	5.7%	8.3%
>200	1.1%	2.6%	1.4%

Basis: 278 replies in 2000; *Included in next category

Table 6. Number of Captive Shop Employees

Range	Fall 1997	Fall 1998	Fall 2000
1-2	*	*	8.1%
3-5	19.7%	22.4%	10.1%
6-10	16.4%	17.9%	14.9%
11-20	21.3%	18.7%	17.6%
21-30	6.6%	5.4%	10.1%
31-50	4.9%	14.9%	6.8%
51-75	11.5%	6.7%	10.1%
76-100	6.6%	2.2%	3.4%
101-200	6.6%	6.0%	6.1%
>200	6.6%	6.0%	12.8%

Basis: 148 replies in 2000; *Included in next category

Sales Volume

The sales volumes for the 259 job shops that responded are summarized in Table 7. The median sales volume was $2.2 million (vs. $1.51 million in 1998) and the average sales per job shop were $4.8 million (vs. $3.2 million in 1998). The percentage of job shops in the upper ranges (above $10,000,000) was higher than previous surveys, reflecting the higher number of employees in the upper ranges, as discussed above.

The sales volumes for the 93 responding captive shops are summarized in Table 8. Reported sales volumes in the categories below $2 million in annual sales was substantially lower than reported in the past, while responses from very large shops (>$20 million) were double, reflecting the employment numbers discussed above. The median captive sales volume was $3.1 million (vs. $1.33 in 1998) and the average sales per captive shop were $9.0 million (vs 5.2 in 1998).

The average sales revenue for job shops from past surveys has ranged from $2.5 million to $3.6 million, with revenue per employee ranging from $75,000 to $89,000. The current job shop data indicate an average of $96,000 in sales revenue per job shop employee. Current captive shop sales data indicate an average of $150,000 in sales revenue per captive shop employee compared to $123,000 in the previous survey. These higher sales per employee ratios may indicate a general increase in productivity in the industry or reflect the strong U.S. economy during the time of the survey.

Table 7. Job Shop Sales Volume

$ Millions	1997	1998	Fall 2000
<0.25	8.7%	11.6%	10.0%
0.25-0.5	11.0%	8.7%	6.2%
0.5-1	15.6%	18.6%	13.5%
1-2	22.1%	21.5%	18.5%
2-3	13.3%	7.6%	12.4%
3-5	12.9%	9.9%	11.6%
5-7	5.3%	9.9%	6.6%
7-10	5.3%	5.2%	6.2%
10-15	3.4%	4.1%	6.9%
15-20	1.2%	1.7%	2.7%
>20	1.2%	1.2%	5.4%

Basis: 259 replies in 2000

Table 8. Captive Shop Sales Volume

$ Millions	1996	1998	Fall 2000
<0.25	*	23.2%	16.1%
0.25-0.5	36.6%	8.5%	6.5%
0.5-1	20.3%	13.4%	9.7%
1-2	8.1%	14.6%	10.8%
2-3	4.9%	6.1%	5.4%
3-5	8.9%	6.1%	7.5%
5-7	0.8%	1.2%	1.1%
7-10	3.3%	3.7%	5.4%
10-15	*	8.5%	9.7%
15-20	*	6.1%	6.5%
>20	17.1%	8.5%	21.5%

Basis: 93 replies in 2000; *Included in next category

CAPITAL EXPENDITURES

The percentages of shops planning major capital expenditures for 2001 are listed in Table 9. The categories include buildings, automated and manual plating/anodizing lines, wastewater treatment, ventilation and air pollution control, and material handling. The calculations for the average expenditures shown in Table 10 are based on all shops responding, with 30-40% of job shops and 40-50% of captive shops indicating that they plan no spending. These were included as "zero" planned spending in the calculation of the averages. In general average captive shop spending is expected to be 50% higher than job shops. In the case of material handling, it is more than double.

Planned equipment spending for 2001 by job and captive shops is summarized in Tables 11 and 12. The categories include filters/pumps, heaters/chillers, rectifiers, tanks/liners, racks, and barrels. Filters/pumps were the most popular, with more than 85% of captive shops and more than 90% of the job shops indicating that they would be purchased. The least likely item to be purchased was barrels with less than 40% for captive shops and less than 50% of job shops responding. Those who indicated "zero" planned spending were included in the calculation of the averages. Once again the average captive shop planned expenditures are higher than those for job shops.

Tables 13 and 14 provide the average expenditures for captive shops and job shops excluding those shops that plan no spending. In Table 13 it can be seen that captive shop spending is about double that of job shops in most categories, with material handling equipment for captive shops triple that of job shops. Average equipment expenditures are higher for captive shops in all categories except racks, as seen in Table 14.

Table 9. Number of Shops Planning Major Capital Expenditures for 2001

	Captive Shops	Job Shops
Building Expansion/Improvement	50.0%	65.3%
Plating/Anodizing Lines	54.8%	68.2%
Wastewater Treatment	56.2%	68.2%
Air Pollution/Ventilation	53.4%	62.1%
Material Handling Equipment	59.6%	61.0%

Basis: 146 captive and 277 job shops

Table 10. Average Major Capital Expenditures for 2001 for All Shops

	Captive Shops	Job Shops
Building Expansion/Improvement	$190,000	$130,000
Plating/Anodizing Lines	$165,000	$120,000
Wastewater Treatment	$75,000	$47,000
Air Pollution/Ventilation	$47,000	$29,000
Material Handling Equipment	$88,000	$31,000

Basis: 146 captive and 277 job shops

Table 11. Number of Shops Planning Equipment Expenditures for 2001

	Captive Shops	Job Shops
Filters/Pumps	85.8%	90.6%
Heaters/Chillers	62.2%	72.1%
Rectifiers	49.3%	69.9%
Tanks/Liners	67.1%	81.9%
Racks	64.2%	81.1%
Barrels	38.5%	47.5%

Basis: 148 captive and 276 job shops

Table 12. Average Equipment Expenditures for 2001 for All Shops

	Captive Shops	Job Shops
Filters/Pumps	$12,600	$9,600
Heaters/Chillers	$10,200	$8,700
Rectifiers	$10,500	$12,600
Tanks/Liners	$15,400	$14,200
Racks	$14,100	$18,700
Barrels	$6,200	$5,700

Basis: 148 captive and 276 job shops

Table 13. Average Major Capital Expenditures for Spending Shops

	Captive Shops	Job Shops
Building Expansion/Improvement	$380,000	$199,000
Plating/Anodizing Lines	$301,000	$176,000
Wastewater Treatment	$133,000	$69,000
Air Pollution/Ventilation	$88,000	$47,000
Material Handling Equipment	$148,000	$51,000

Basis: 73 to 87 captive and 169 to 189 job shops

Table 14. Average Equipment Expenditures for Spending Shops

	Captive Shops	Job Shops
Filters/Pumps	$14,700	$10,600
Heaters/Chillers	$16,400	$12,100
Rectifiers	$21,300	$18,000
Tanks/Liners	$23,000	$17,300
Racks	$22,000	$23,100
Barrels	$16,100	$12,000

Basis: 57 to 127 captive and 131 to 250 job shops

MATERIAL USAGE

Processes Employed

The survey requested information on 28 of the most frequently used plating and surface treatment processes employed by both captive and job shops. Data were collected and are reported in this section on the percentage of each process used and the percentage of the purchased chemicals for each process that was proprietary. Also, the reported data were adjusted for the number of employees (relative to the average) of each responding metal finishing operation. Furthermore, to report and discuss the data, the processes have been grouped as follows:

- Nickel and Chromium
- Cadmium and Zinc
- Copper and Alloys
- Gold, Silver, and Tin
- Surface Treatments

Nickel and Chromium

Respondents were asked to indicate whether they used one or more particular processes involving nickel and/or chromium. The results for job shops are shown in Table 15. The percentages do not add up to 100% because many respondents are engaged in more than one process.

Table 15. Nickel and Chromium Plating in Job Shops

Process	% Used 1998	% Used 2000
Dec Cr (+6)	25.5%	26.2%
Hard Cr	18.8%	17.2%
Dec Cr (+3)	8.9%	14.5%
Electroless Ni	27.0%	31.3%
Sulfamate Ni	26.0%*	12.5%
Watts Ni	35.4%*	50.0%

***Believed to be inaccurate due to confusion in reporting**

Watts nickel, as expected, was the most commonly used process followed by electroless nickel and decorative hexavalent chrome. The nickel sulfamate usage was much higher than anticipated in the previous survey. It is likely that some respondents in that previous survey who reported nickel sulfamate confused it with the nickel sulfate of Watts nickel.

Table 16 shows the results for captive shops. Once again, the nickel processes predominate. It is interesting to note that electroless nickel is 50% more likely to be used in job shops, as compared to captive shops.

Table 16. Nickel and Chromium Plating in Captive Shops

Process	% Used 1998	% Used 2000
Dec Cr (+6)	14.1%	20.5%
Hard Cr	9.6%	14.4%
Dec Cr (+3)	11.9%	8.3%
Electroless Ni	15.6%	22.7%
Sulfamate Ni	23.7%*	8.3%
Watts Ni	23.0%*	54.5%

*Believed to be inaccurate due to confusion in reporting

Cadmium and Zinc

At one time cyanide zinc dominated the market for zinc electrodeposition. The results reported in Tables 17 and 18 indicate that this is no longer the case with cyanide zinc, now the least favored of the pure zinc processes. The usage of cadmium continues quite strongly in job shops, but is much less favored by captive finishers. It is probable that job shops are more willing to bear the responsibility of environmental compliance with cadmium than are the captive shops, so the latter choose to outsource to the former. Acid zinc is the most popular process among both captive and job shop finishers. Job shops are also more likely to use alkaline zinc, which can provide better metal distribution, especially on complicated parts. The increase in cyanide zinc usage by job shops from 1998 to 2000 is believed to be due to the fact that above 0.5 mil thickness zinc cyanide provides a more flexible deposit than acid zinc. Quality requirements are forcing thickness levels upward.

Table 17. Cadmium and Zinc Plating in Job Shops

Process	% Used 1998	% Used 2000
Cadmium	14.1%	16.0%
Acid Zn	20.3%	20.3%
Alkaline Zn	16.7%	18.0%
Cyanide Zn	6.8%	10.9%
Zn Alloys	7.3%	8.6%

Table 18. Cadmium and Zinc Plating in Captive Shops

Process	% Used 1998	% Used 2000
Cadmium	9.8%	7.6%
Acid Zn	12.6%	10.6%
Alkaline Zn	4.4%	7.6%
Cyanide Zn	4.4%	3.0%
Zn Alloys	6.7%	3.8%

Copper and Copper Alloys

As can be seen from Tables 19 and 20, acid and cyanide copper dominate this group for both captive and job shops. Brass plating processes are next in line, with alkaline copper and electroless copper on the same level only in captive shops. The continued use of cyanide copper is not surprising because it is widely used as a strike or pre-plate for ensuring adherence of subsequent multiple-layer deposits for hard-to-handle substrates such as zinc die castings.

Table 19. Copper and Copper Alloy Plating in Job Shops

Process	% Used 1998	% Used 2000
Brass	13.0%	11.7%
Bronze	4.2%	3.9%
Acid Cu	24.0%	22.7%
Alkaline Cu	6.3%	3.9%
Cyanide Cu	27.1%	32.0%
Electroless Cu	6.3%	4.3%

Table 20. Copper and Copper Alloy Plating in Captive Shops

Process	% Used 1998	% Used 2000
Brass	8.9%	11.7%
Bronze	3.7%	6.5%
Acid Cu	17.0%	22.0%
Alkaline Cu	3.0%	10.6%
Cyanide Cu	15.6%	18.2%
Electroless Cu	5.2%	10.6%

Gold, Silver, and Tin

Gold is the most frequently reported process of this group for captive shops, as shown in Tables 21 and 22. For job shops, gold, silver, and acid tin are equally popular.

Table 21. Gold, Silver, and Tin Plating in Job Shops

Process	% Used 1998	% Used 2000
Gold	21.3%	23.8%
Silver	17.7%	25.0%
Acid Tin	19.3%	22.7%
Stannate	12.5%	10.5%
Tin-Lead	12.0%	11.7%

Table 22. Gold, Silver, and Tin Plating in Captive Shops

Process	% Used 1998	% Used 2000
Gold	20.7%	27.3%
Silver	16.3%	18.9%
Acid Tin	9.6%	19.7%
Stannate	4.4%	6.1%
Tin-Lead	7.4%	14.4%

Surface Treatments

In addition to seeking information on plating processes, data were also sought for a number of related metal finishing treatment processes. These results are reported in Tables 23 and 24. Processes for cleaning and pretreatment, as expected, are the most widely used by both captive and job shop finishers. Stripping is in use in nearly 50% of the job shops and nearly 40% of the captive shops. Chromate conversion coatings are also widely used in about one-half of the job shops and one-third of the captive shops. Anodizing is more likely to be used in job shops, while electropolishing is more frequently found in captive shops.

Table 23. Surface Treatments in Job Shops

Process	% Used 1998	% Used 2000
Anodize	21.4%	22.7%
Hardcoat	14.1%	15.2%
Chromate	42.7%	44.1%
Electropolish	14.6%	14.5%
Pretreatment	76.6%	51.6%
Stripping	61.5%	46.9%

Table 24. Surface Treatments in Captive Shops

Process	% Used 1998	% Used 2000
Anodize	17.0%	19.7%
Hardcoat	15.6%	13.6%
Chromate	31.1%	28.8%
Electropolish	17.0%	16.7%
Pretreatment	60.7%	43.2%
Stripping	42.2%	37.1%

Most Popular Plating Processes

The ten most popular plating processes, based on Tables 15 to 22, are reported in Tables 25 and 26. Table 25 lists the ten most popular plating processes in job shops in order of frequency. Watts nickel is by far the most popular, with cyanide copper second, closely followed by electroless nickel.

Table 26 lists the ten most popular plating processes in captive shops. Once again, Watts nickel tops the list, followed by gold and then electroless nickel and acid copper. The mix of processes suggests that captive shops are more likely to be involved in finishing for the electronics industry than job shops.

Generally speaking, job shops tend to have a broader usage of processes. In comparing the top ten listings for captive and job shops the lists are very much alike, with only a few exceptions. Tin-lead appears on the list for captive shops but not on the job shop list, while acid zinc appears on the job shop list and not on the list for captives.

Table 25. Ten Most Popular Job Shop Plating Processes

Process	Usage
Watts Ni	50.0%
Cyanide Cu	32.0%
Electroless Ni	31.3%
Dec Cr (+6)	26.2%
Silver	25.0%
Gold	23.8%
Acid Cu	22.7%
Acid Sn	22.7%
Acid Zn	20.3%
Hard Cr	17.2%

Table 26. Ten Most Popular Captive Shop Plating Processes

Process	Usage
Watts Ni	54.5%
Gold	27.3%
Electroless Ni	22.7%
Acid Cu	22.0%
Dec Cr (+6)	20.5%
Acid Sn	19.7%
Silver	18.9%
Cyanide Cu	18.2%
Sn-Pb	14.4%
Hard Cr	14.4%

ANODE AND CHEMICAL MARKETS

In the last report, an attempt was made to estimate the total market for proprietary chemicals and anodes. The procedure was to first obtain the amounts of materials purchased by captive and job shops for each of 28 plating and surface treatment processes and also 10 types of soluble anodes for plating. The purchase amounts were averaged and then extended to the entire marketplace by scaling up the data. After publication, there were several statements from chemical suppliers that the market amounts expressed in total dollars were overstating actual sales.

The subject was addressed in two ways. First, the questions were repeated with an improved questionnaire layout. The results for the average dollar expenditures of the captive and job shops responding are given in Tables 27 to 30, for proprietary materials, and in Table 31, for anodes. The comparable numbers from the last report (1998) are given as a combined average value for both groups. The order of presentation (from top to bottom) is from the largest to smallest market, as determined in the previous report. The average annual purchases are substantially lower than last year for most processes, indicating that the previous data were likely overstated.

In reviewing the raw data, it was noted that many shops reported values less than the smallest of the ranges possible. This makes the average values somewhat suspect in a number of cases. Also, in a few cases, one or two very large consumers skew the averages substantially. The data for shop size and sales volume also show that the distribution of finishing plants is not normal but rather very flat, which means that a true statistical "average" cannot be calculated.

Table 27. Annual Purchases of Proprietary Plating Chemicals

Process	All Shops 1998	Captive Shops 2000	Job Shops 2000
Gold	$82,400	$45,600	$53,000
Watts Ni	$36,700	$26,400	$20,600
Acid Zn	$53,100	$32,700	$49,100
Sulfamate Ni	$37,000	$12,500	$16,100
Dec Cr (+6)	$41,700	$18,800	$45,900
Hard Cr	$42,700	$57,100	$18,300
Dec Cr (+3)	$41,900	$17,500	$15,300

Table 28. Annual Purchases of Proprietary Plating Chemicals

Process	All Shops 1998	Captive Shops 2000	Job Shops 2000
Silver	$29,600	$51,300	$17,300
Acid Cu	$22,100	$28,200	$16,400
Acid Sn	$35,100	$16,500	$11,800
Cyanide Cu	$17,900	$8,600	$19,000
Zinc Alloys	$46,900	$21,000	$23,100
Alkaline Zn	$37,300	$21,300	$34,900
Cadmium	$23,900	$16,300	$17,300

Table 29. Annual Purchases of Proprietary Plating Chemicals

Process	All Shops 1998	Captive Shops 2000	Job Shops 2000
Sn-Pb	$27,100	$11,800	$14,600
Brass	$28,500	$19,200	$4,800
Alkaline Cu	$11,300	$16,800	$7,500
Stannate	$18,000	$4,400	$10,200
Cyanide Zn	$17,300	$2,500	$19,000
Bronze	$25,700	$16,700	$3,000

Table 30. Annual Purchases of Proprietary Surface Treatments

Process	All Shops 1998	Captive Shops 2000	Job Shops 2000
Pretreatment	$47,100	$20,600	$23,800
Electroless Ni	$67,500	$50,500	$57,700
Strippers	$24,400	$12,600	$8,300
Chromates	$18,900	$15,100	$13,600
Hardcoat	$33,300	$13,600	$7,600
Anodizing	$22,300	$25,900	$14,500
Electroless Cu	$50,400	$69,000	$28,400
Electropolish	$17,300	$17,400	$12,900

Table 31. Annual Purchases of Anodes

Metal	All Shops 1998	Captive Shops 2000	Job Shops 2000
Nickel	$42,700	$33,200	$48,300
Zinc	$40,000	$9,600	$31,300
Tin	$32,400	$17,100	$14,000
Silver	$45,100	$9,200	$25,900
Copper (Acid)	$31,700	$20,200	$30,800
Copper (CN)	$18,400	$31,800	$13,300
Solder	$17,400	$19,600	$14,200
Cadmium	$8,600	$4,600	$6,900

Select Committee

It was obvious that a different method was needed to properly estimate the market sizes for proprietary plating and surface treatment chemicals and anodes. The method chosen was to assemble a select committee of marketing personnel from the major chemical supply companies, have them provide their own estimates of the market sizes, and then average the results or reach a consensus where the estimates varied substantially.

Two such meetings were held and the results are reported below. These values represent market size estimates for the calendar year of 1999 for the North American market, including the U.S.A., Canada, and Mexico. The totals for all materials reported include general metal finishing and electronics applications, but not printed circuit boards. Figures for several materials were insufficiently documented to publish at this time.

Nickel and Chromium

The estimates for nickel plating additive chemicals averaged $45 million based, on nickel anode consumption of 16,600 metric tons in 1998. There was general agreement on this amount, with the range from a low of $43 million to a high of $48 million.

Combined figures were provided for decorative and hard chromium from hexavalent chromium baths. These were based on chromic acid production and were reported as $12,500,000 by one supplier that includes chromic acid with its additive product, and $10,500,000 by a second supplier that does not include the chromic acid. Two separate issues need to be considered: inclusion of the chromic acid and inclusion of mist suppressants.

There was better agreement on the additive chemical market for trivalent chromium. The average was $2.9 million, with the range from $2.2 million to $3.5 million.

Estimates for electroless nickel hinged on whether or not plating of memory disks was to be included. Without the disks, the average was $47 million (range $35 million to $52 million). The total market with disks was estimated as $70 million (range $60 million to $75 million).

Tin

Tin plating additive consumption was given as between $4.5 million and $5.5 million for a combination of methane sulfonic acid and sulfate baths, with about $0.5 to $0.75 million for fluoborate solutions. It should be noted that these totals do not include the additives sold to tin mills. An estimate was made that about one-third of the tin mills utilize proprietary additives, a substantial market on its own. Anode consumption by tin mills was estimated at 800 tons per month for the U.S.A., 100 tons per month for Canada, and 40 tons per month for Mexico.

Zinc and Chromate Conversion Coatings

It was agreed to report six separate items for zinc plating, including alkaline non-cyanide, acid chloride, cyanide, alloys, and chromate conversion coatings, plus an overall total. These figures are shown in Table 32. There was remarkable agreement for alkaline non-cyanide zinc, acid chloride zinc, and zinc alloys. The numbers were consistent in that those reporting higher values for individual processes also tended to report higher totals.

Table 32. Estimated Market Size for Zinc Plating Processes

Process	Low	Average	High
Alkaline Non-CN Zinc	$15,000,000	$16,000,000	$16,000,000
Acid Zinc	$22,000,000	$24,000,000	$26,000,000
Cyanide Zinc	$2,000,000	$2,500,000	$4,000,000
Zinc Alloys	$4,000,000	$5,000,000	$6,000,000
Chromates	$15,000,000	$16,000,000	$19,000,000
Total	$58,000,000	$63,000,000	$69,000,000

Precious Metals

Estimates for two precious metal materials were provided. The estimate for gold was 800,000 troy ounces for the metal and $7.8 million for additives. Palladium was estimated at 4,200 kilograms for the metal and $4.0 million for additives.

Pretreatment Chemicals and Strippers

Estimates were provided for pretreatment chemicals for plastics. A consensus figure could not be agreed upon with the majority leaning toward about $14 million, while one holdout insisted on a level of only $8 million.

Pretreatment chemicals prior to plating were broken into two categories by some (alkaline cleaners and acid salts), while others reported a total. No consensus could be reached on a proper definition of the universe. The ranges were $4 to $12 million for acid salts and $28 to $65 million for alkaline cleaners. Total figures ranged from $32 to $77 million. The range for metal strippers was $6.5 to $12.8 million, with the latter considered more reliable.

WAGES AND BENEFITS

Union Participation

Respondents were asked for the status of their production staff relative to union membership. The results are shown in Table 33. Captive shops reported that 21.9% of employees were unionized, versus 9.1% reported by job shops. There were 7.5% of captive shops and 1.8% of job shops reporting a combination of union and non-union employees. This leaves 70.6% of captive shops and 89.1% of job shops as non-union facilities.

Table 33. Union Membership for Production Employees in Finishing

	Captive Shops	Job Shops
Unionized	21.9%	9.1%
Combination	7.5%	1.8%
Non-Unionized	70.6%	89.1%

Basis: 146 captive and 275 job shop responses

Compensation for Hourly Employees

Tables 34 and 35 summarize the response to a question related to hourly pay rates for various production positions for both captive and job shops. With the exception of QC inspector, captive shops tend to pay higher wages for all production positions. For both job and captive shops, the lowest average pay rate was for rackers and the highest for shop foreman. Pay rates in job shops range from $8.63 for rackers to $20.60 for shop foreman. Comparable numbers for captive shops were $10.80 for rackers and $22.44 for shop foreman.

Table 34. Hourly Pay Rates for Production Employees

Position	Captive Shops	Job Shops
Tank Operator	$12.86	$11.20
Lead Person	$16.00	$13.96
Racker	$10.80	$8.63
Polisher/Buffer	$12.68	$11.98
Waste Treatment Operator	$15.59	$13.10

Basis: 132 captive and 259 job shop responses

Table 35. Hourly Pay Rates for Production Employees

Position	Captive Shops	Job Shops
Lab Technician	$16.74	$14.72
QC Inspector	$14.27	$14.23
Supervisor	$21.97	$18.00
Shop Foreman	$22.44	$20.60

Basis: 132 captive and 259 job shop responses

Racker is considered an entry-level position in most shops, so this position was selected to investigate variations in pay rates. Table 36 gives the hourly pay rates for rackers in all finishing shops as a function of geographical area. Also indicated is whether a shop is or is not unionized. For purposes of this comparison, shops with partial unionization of production employees are included with unionized shops. The overall averages were $10.98 per hour for union shops and $9.24 for non-union shops.

Table 37 shows hourly pay rates as a function of union membership and geographical area for job shops. Overall averages were $9.64 per hour for unionized job shops and $8.82 per hour for non-unionized job shops. In some geographical areas it was not possible to calculate pay rates due to an insufficient number of responses. This was especially true for unionized job shops, which represent only about 10% of the total job shops responding. Unionized employees were paid at higher rates in all areas except the West Central states.

Table 36. Hourly Pay Rates for Rackers in All Shops

Area	Unionized*	Non-Unionized
New England	$11.00	$10.00
Mid-Atlantic	$9.86	$8.84
Southeast	$10.33	$8.38
East Central	$13.63	$9.50
West Central	$9.08	$9.78
Southwest	#	$8.15
West	$14.20	$9.74

*** Includes shops with partial unionization # Insufficient responses**

Table 37. Hourly Pay Rates for Rackers in Job Shops

Area	Unionized*	Non-Unionized
New England	#	$9.50
Mid-Atlantic	#	$8.00
Southeast	#	$7.75
East Central	$10.00	$9.17
West Central	$8.14	$9.96
West	$14.50	$8.97

* Includes shops with partial unionization # Insufficient responses

Employee Benefits

Respondents were queried regarding benefits offered to salaried and hourly employees. Their responses are summarized in Tables 38 to 41.

Table 38. Benefits Offered to Captive Shop Production Employees

Position	Salaried	Hourly
Health Insurance	95.9%	95.9%
Paid Vacations	95.3%	93.9%
Retirement Plan	91.9%	87.2%
Dental Insurance	84.5%	83.1%
Sick Leave	83.1%	58.8%
Profit Sharing	50.7%	47.3%
Expense Accounts	35.1%	7.4%

Basis: 148 responses

Table 39. Benefits Offered to Captive Shop Production Employees

Position	Salaried	Hourly
Bonuses	57.4%	41.9%
Vision Plan	55.4%	53.4%
Automobile	2.7%	0.0%
Free Meals (1x/wk)	1.4%	8.8%
Cafeteria Plan	8.8%	8.8%
Uniforms/Shoes	40.5%	59.5%

Basis: 148 responses

Table 40. Benefits Offered to Job Shop Production Employees

Position	Salaried	Hourly
Health Insurance	86.8%	87.6%
Paid Vacations	89.5%	92.5%
Retirement Plan	64.7%	64.7%
Dental Insurance	52.6%	52.3%
Sick Leave	44.7%	37.6%
Profit Sharing	42.1%	38.0%
Expense Accounts	27.8%	2.6%

Basis: 266 responses

Table 41. Benefits Offered to Job Shop Production Employees

Position	Salaried	Hourly
Bonuses	67.7%	60.2%
Vision Plan	26.3%	22.9%
Automobile	20.7%	2.6%
Free Meals (1x/wk)	7.5%	6.0%
Cafeteria Plan	12.0%	12.4%
Uniforms/Shoes	37.6%	53.8%

Basis: 266 responses

The vast majority of both job and captive shops offer employees health insurance and paid vacations. Approximately 90% of captive shops offer retirement plans, whereas two-thirds of job shops do so. Generally speaking, captive shops offer better benefits than job shop. The primary exceptions are bonuses and use of an automobile.

Benefits offered to salaried employees were generally better than to hourly employees especially regarding expense account and automotive use. One primary exception was uniforms/shoes, which are much more likely to be offered to hourly employees.

The final question relating to employee benefits concerned the total overall benefits cost as a percentage of payroll, excluding FICA and workman's compensation. Results are shown in Table 42. The average overall cost was 19.6% for job shops and 23.5% for captive shops.

Table 42. Overall Cost of Employee Benefits as a Percentage of Payroll

Range	Captive Shops	Job Shops
<10%	9.4%	18.6%
10-20%	32.1%	40.3%
21-30%	35.8%	24.6%
31-40%	14.2%	13.1%
41-50%	6.6%	0.0%
51-60%	1.9%	2.5%
>60%	0.0%	0.8%

JOB SHOP CUSTOMER PROFILE

Number of Customers

Job shops were asked to estimate the number of customers served annually. The results are shown in Table 43. The average number was 195.

We also asked what percentage of the customers was new. Table 44 gives the breakdown. The average was 12.8%.

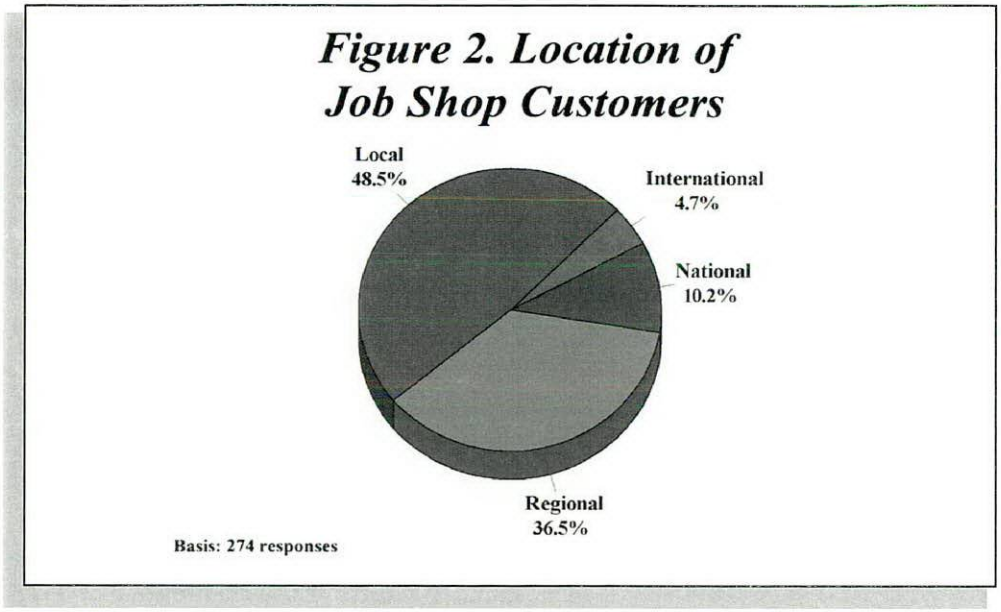
Table 44. Percentage of New Customers Served in 1999 by Job Shops

Range	Response
<5%	23.3%
5-10%	37.8%
11-20%	22.2%
21-30%	11.1%
31-40%	2.6%
41-50%	1.1%
>50%	1.9%

Basis: 270 responses

Customer Location

A question was asked relating to the geographical location of the majority of a shop's customers. The result is shown in Figure 2. Local was defined as within 100 miles, regional as up to 500 miles, and national as more than 500 miles.



Promotion of Services

Job shops were asked how they promote their finishing services. The responses are summarized in Table 45. Note that responses add up to much more than 100% because shops generally use more that more than one method to promote their services. The most popular techniques include the use of yellow pages, establishment of a web site, and the use of business directories. It was surprising to find such a high percentage of job shops using web sites. Utilization of direct salesmen and sales representatives was also very popular. Nearly 10% wrote in that they depended on "word-of-mouth" for new customers.

Table 45. Methods Used by Job Shops to Promote Services

Method	Usage
Yellow Pages	50.4%
Web Sites	49.2%
Business Directories	48.5%
Sales Reps	46.6%
Direct Salesmen	45.8%
Direct Mail	25.8%
Exhibit at Shows	25.4%
Magazine Advertising	13.2%
Word of Mouth	9.8%

Basis: 264 responses

RESOURCE RECOVERY

In general, it can be stated that resource recovery can be considered an integral important part of today's electroplating production process.

Respondents were asked to indicate whether they had implemented a number of techniques for waste minimization and if these techniques had proven successful. The responses from 345 captive and job shops are listed in Table 46 according to their popularity of use. By far the most popular technique was drag-out tanks with 66.7% of responders using it. The next most popular techniques are air agitation in rinses, increased number of counter flow rinse tanks, addition of wetting agents, and redesign of racks. Although up-rotation of barrels was considered as the least popular, it should be noted that many shops are not involved in barrel plating.

Table 46 also provides information as to the effectiveness of each technique. The methods that worked best were increasing the number of counterflow rinses and addition of drag-out tanks. Next were redesign of racks and addition of rinse controllers. Decreasing solution concentration was considered as the least efficient waste minimization technique of those listed.

Recovery processes used for a variety of common plating solutions were reported by 238 captive and job shop respondents. Respondents were asked to indicate which of six techniques they use. The techniques listed included the following:

Table 46. Effectiveness of Popular Waste Minimization Techniques

Technique	% Using	Worked Well
Drag-Out Tanks	66.7%	80.4%
Air-Agitated Rinses	39.7%	67.2%
Counterflow Rinses	38.6%	81.2%
Wetting Agents	37.1%	67.2%
Redesigned Racks	35.1%	73.6%
Fog/Spray Rinses	31.9%	69.1%
Rinse Controllers	31.3%	73.1%
Increase Transfer Time	28.1%	53.6%
Increase Solution Temperature	20.6%	53.5%
Air Knives	19.7%	67.6%
Decreased Bath Concentration	19.1%	48.5%
Barrel Up-Rotation	12.2%	69.0%

Basis: 345 responses from captive and job shops

Electrowinning, or electrolytic metal recovery, is a technique in which direct current electrolysis is used to deposit metal on a cathode to lower the concentration of dissolved metals in many types of rinse waters. This avoids conversion of the metal to sludge and, in some cases, permits recovery of the metal values.

Evaporation is a thermally driven recovery technique that removes the water of dilution, either by air humidification at atmospheric pressure (*atmospheric evaporation*) or by controlled boiling at reduced pressure and temperature (*vacuum evaporation*), so the recovered and concentrated drag-out can be returned directly to the plating bath.

Ion exchange is a reversible, chemically driven process that can be used for treating very dilute solutions of dissolved metal salts by sorbing them on specially prepared porous organic materials. These ion exchange resins, which are usually in a bead or particle form, capture the dissolved ions and are then chemically stripped of the sorbed ions to recover them in the form of a more concentrated solution.

Micro/Ultrafiltration are membrane separation techniques that operate at low to moderate pressures to separate particulates or macromolecules from solutions to permit recovery of the purified solutions or to recycle water.

Reverse osmosis is a recovery and concentration technique that imposes hydraulic pressure across a semipermeable membrane to reverse the natural tendency of water to directionally migrate through the membrane into a solution of higher concentration. This allows some dewatering and recovery of the ionic species from dilute aqueous solutions.

Table 47 shows the overall usage of the six recovery techniques. The most popular was ion exchange, which was reported by 89.9% of those responding. The next most popular was atmospheric evaporators used by 86.6%.

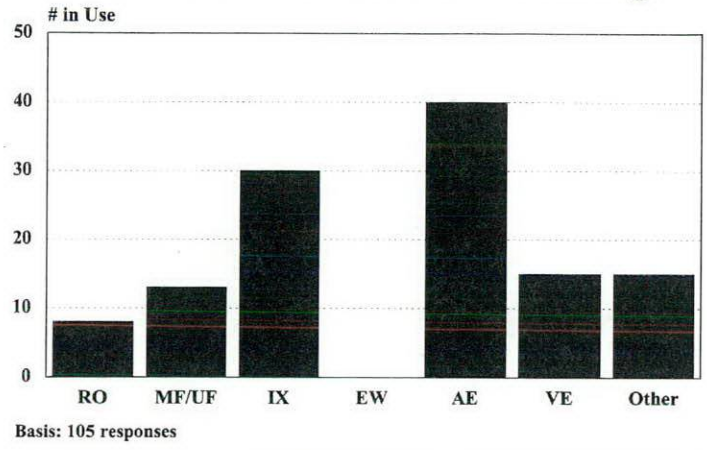
Table 47. Resource Recovery Techniques in Use

Process	Notation	Usage
Ion Exchange	IX	89.9%
Atmospheric Evaporation	AE	83.6%
Micro/Ultrafiltration	MF/UF	48.7%
Electrowinning	EW	28.2%
Reverse Osmosis	RO	25.2%
Vacuum Evaporation	VE	18.9%
Others	Other	41.6%

Basis: 238 responses, some selected more than one method

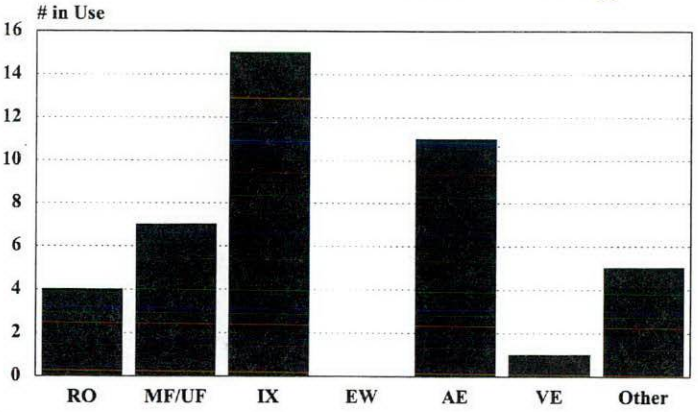
Figures 3 to 18 indicate the number of respondents utilizing a particular technique for each of 15 commonly used plating baths plus those techniques used on general rinses for recovery of water. The percentages for any particular plating bath do no necessarily add up to 100% because some respondents use more than one technique.

Figure 3. Recovery Methods Used for Hexavalent Chromium Plating



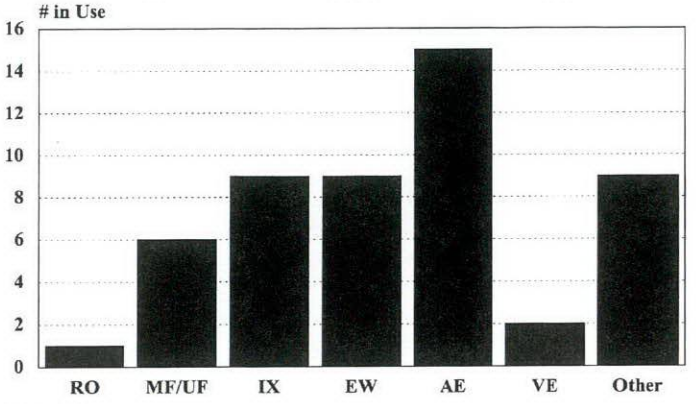
Basis: 105 responses

Figure 4. Recovery Methods Used for Trivalent Chromium Plating



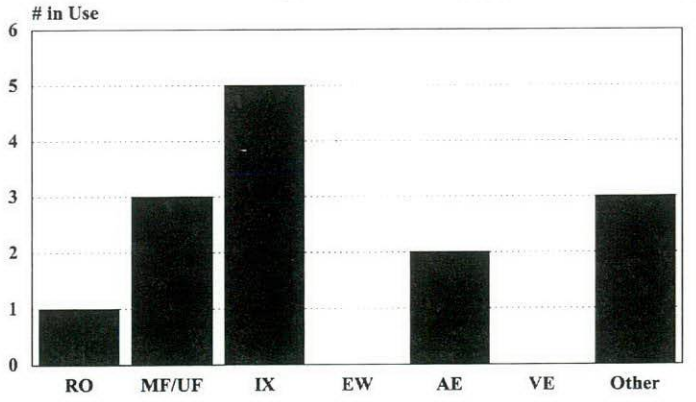
Basis: 41 responses

Figure 5. Recovery Methods Used for Cyanide Copper Plating



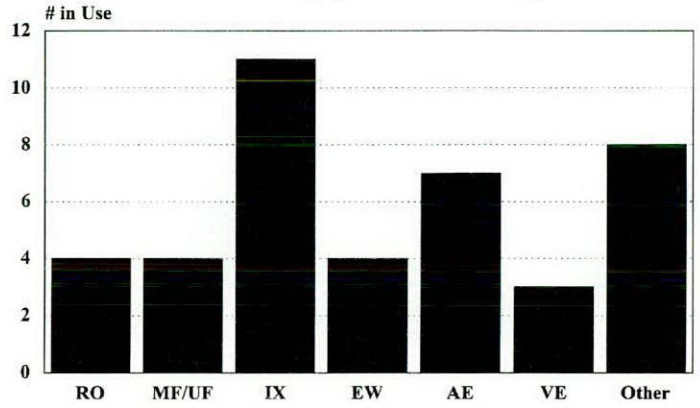
Basis: 47 responses

Figure 6. Recovery Methods Used for Alkaline Non-Cyanide Copper Plating



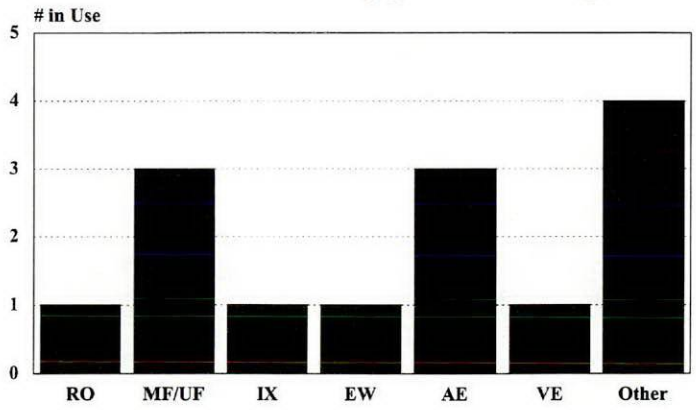
Basis: 14 responses

Figure 7. Recovery Methods Used for Acid Copper Plating



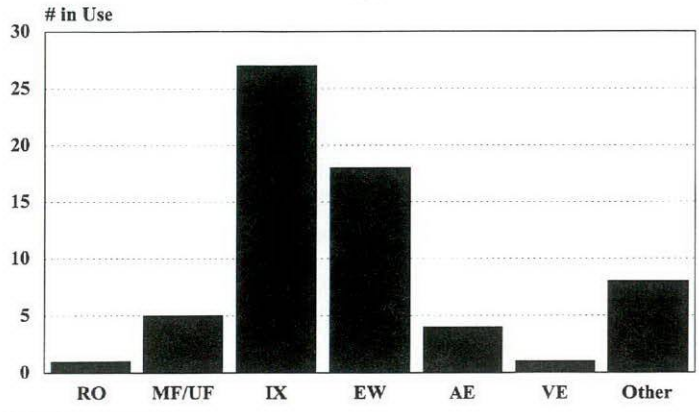
Basis: 36 responses

Figure 8. Recovery Methods Used for Electroless Copper Plating



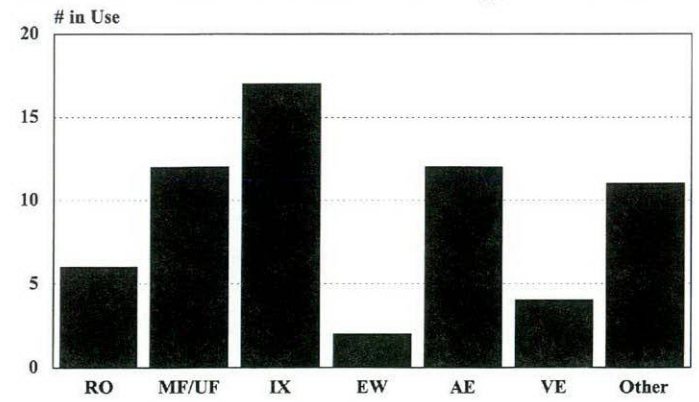
Basis: 12 responses

Figure 9. Recovery Methods Used for Gold Plating Processes



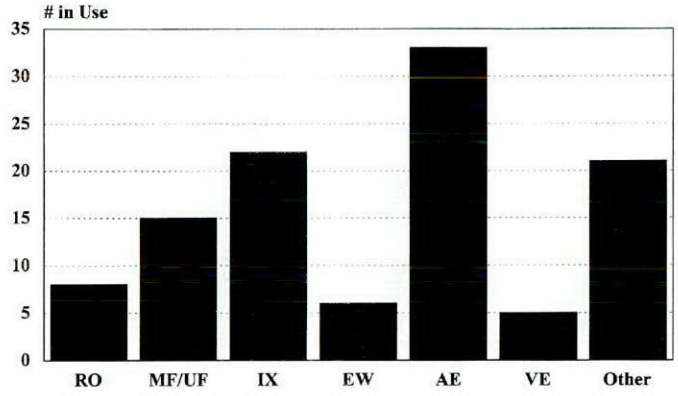
Basis: 54 responses

Figure 10. Recovery Methods Used for Electroless Nickel Plating Processes



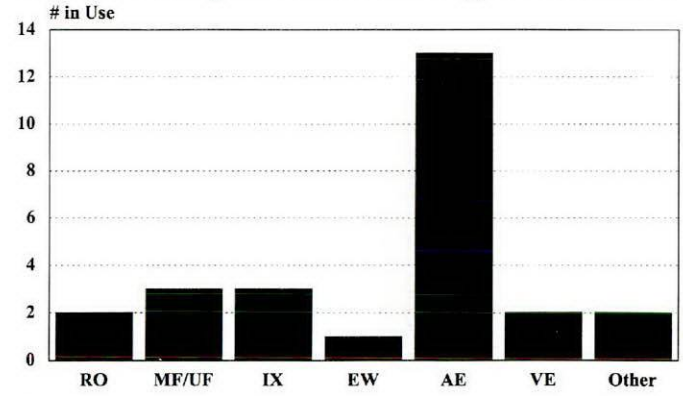
Basis: 52 responses

Figure 11. Recovery Methods Used for Watts Nickel Plating Processes



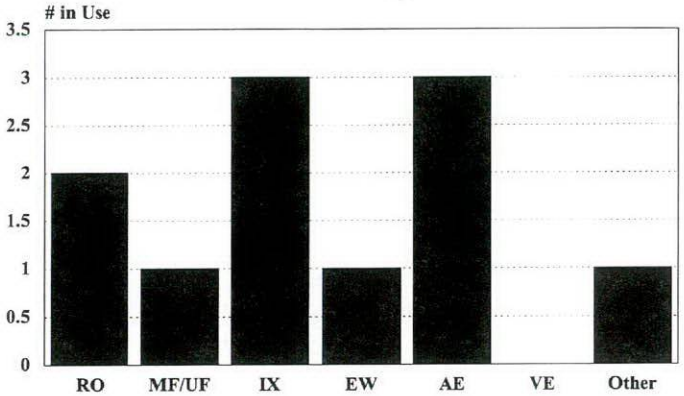
Basis: 95 responses

Figure 12. Recovery Methods Used for Nickel Sulfamate Plating Processes



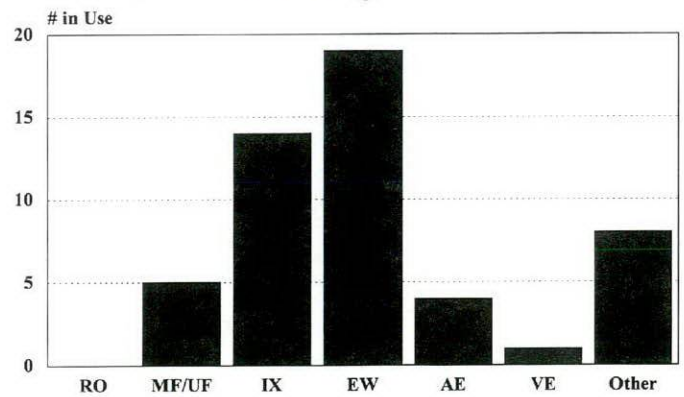
Basis: 22 responses

Figure 13. Recovery Methods Used for Palladium Plating Processes



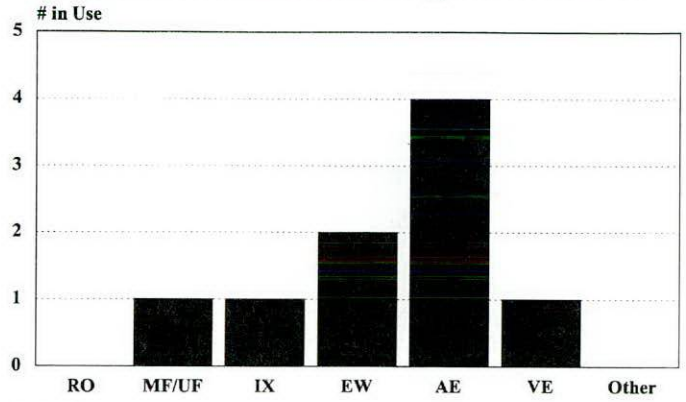
Basis: 10 responses

Figure 14. Recovery Methods Used for Silver Plating Processes



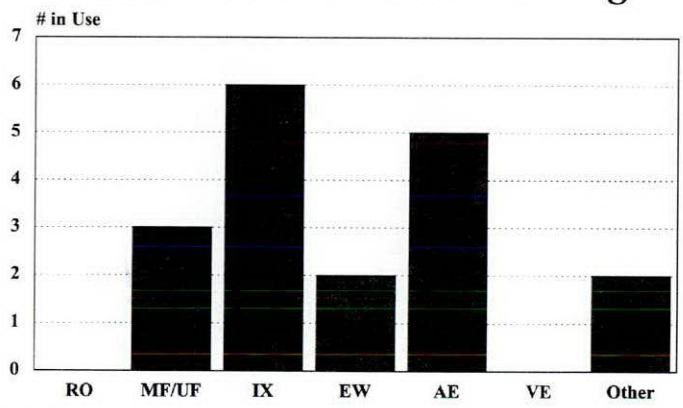
Basis: 45 responses

Figure 15. Recovery Methods Used for Cyanide Zinc Plating Processes



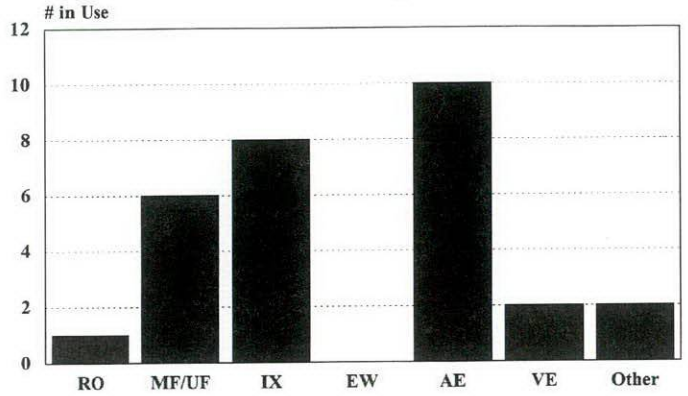
Basis: 8 responses

Figure 16. Recovery Methods Used for Alkaline Non-CN Zinc Plating



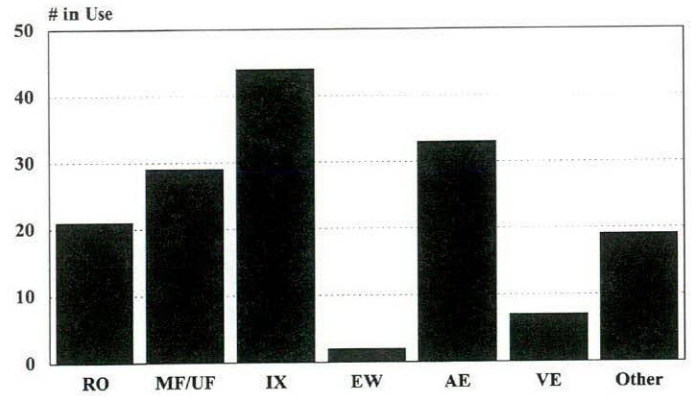
Basis: 18 responses

Figure 17. Recovery Methods Used for Acid Zinc Plating Processes



Basis: 27 responses

Figure 18. Recovery Methods Used for General Rinsewater



Basis: 123 responses

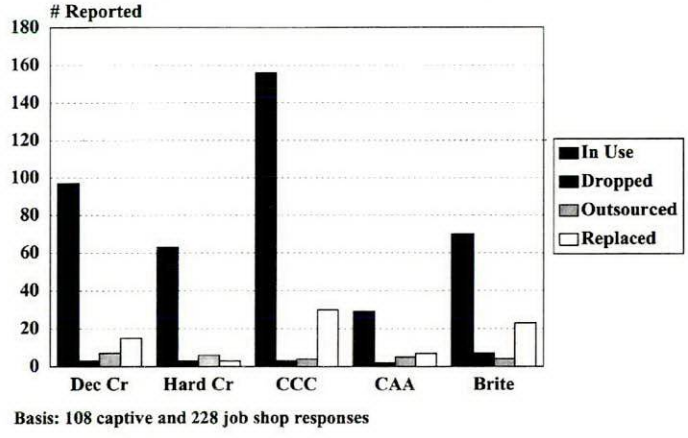
HAZARDOUS PROCESS SUBSTITUTION

In addition to soliciting information on the use of resource recovery techniques used by metal finishers, captive and job shops were requested to submit data from the last 10 years on the substitution and/or elimination of processes using hexavalent chromium and cyanide.

Solutions Based on Hexavalent Chromium

Figure 19 summarizes the results from captive and job shops for the five processes utilizing hexavalent chromium. These include decorative and hard chromium plating, chromate conversion coatings (CCC), chromic acid anodizing (CAA), and chromic acid bright dipping of brass and copper (Brite). Indicated is the number of shops that continue to use the process, those that have dropped or outsourced the process, and those that have replaced it. Details on each process are discussed below.

Figure 19. Elimination/Replacement of Hexavalent-Chromium-Based Processes

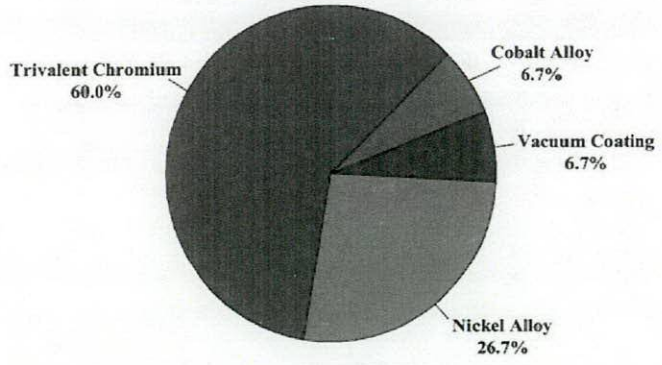


Basis: 108 captive and 228 job shop responses

The first solution considered was decorative chromium plating, using a chromic acid bath. There were 122 responses to this question. Of this number, 97 (79.5%) still use the process. Of the remaining 25 (20.5%), there were seven who chose to outsource and three who dropped the process. The choices of the 15 who selected replacements are shown in Figure 20. Trivalent chromium plating is the primary replacement technology.

A total of 75 shops responded to the question relating to hard chromium plating from a chromic acid bath. Of these, 84% continue to use the process. Most of the remainder has discontinued use. Only a few replacements have been reported. These chose electroless nickel or nickel alloy plating processes.

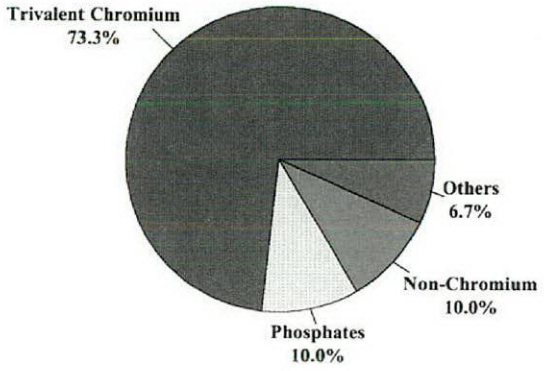
Figure 20. Replacements for Decorative Hexavalent Chromium Plating



Basis: 15 responses

The most popular process within this group is chromate conversion coating, with 193 shops responding to this question. Of these, 156 (80.8%) continue to use this process and 37 (19.2%) have eliminated or replaced these coatings. Within this latter group, four have decided to outsource and three to drop the process. The options for replacement by the remaining 30 are shown in Figure 21. The most popular alternative is trivalent-chromium-based materials.

Figure 21. Replacements for Chromate Conversion Coatings

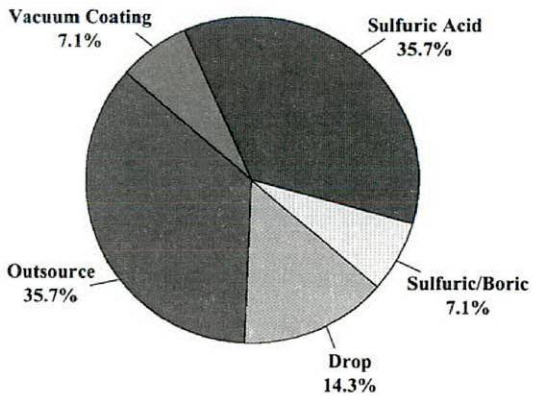


Basis: 30 responses

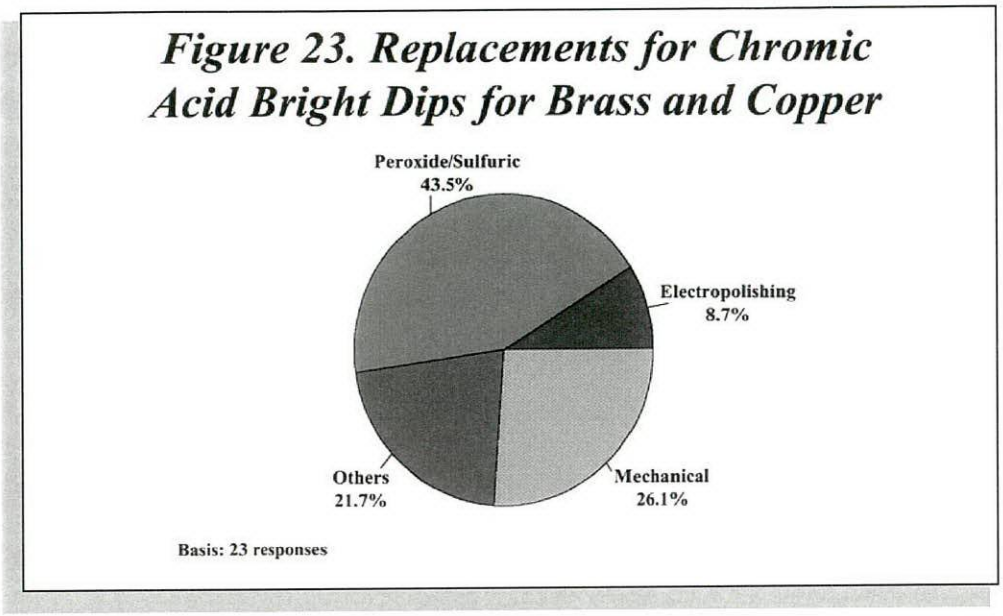
The next process considered was chromic acid anodizing, with 43 shops reporting. Of these 29 (67.4%) continue to use the process. Selections for replacement/elimination are shown in Figure 22 with elimination favored and sulfuric acid anodizing as the most popular replacement.

The final chromic acid bath for which data were obtained concerns bright dipping of brass and copper. There were 104 shops responding to this question. Of these, 70 (67.3%) continue to use the process. Of the remaining 34 (32.7%), there were seven dropping the process and four choosing to outsource. Options for replacement by the rest are shown in Figure 23. Others involved five different processes, including several different bath compositions and decorative plating.

Figure 22. Elimination/Replacement for Chromic Acid Anodizing



Basis: 14 responses



Solutions Based on Cyanide

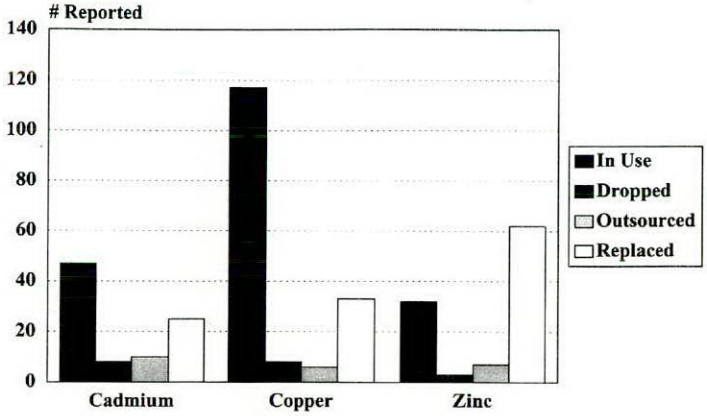
Figure 24 summarizes the results for cyanide-based plating processes. Three processes were considered: cadmium, copper, and zinc. Each will be discussed below.

There were 90 shops responding on the question related to cadmium plating from a cyanide bath. Of these, 52.2% continue to use this process. The primary choice was to eliminate usage, with 10 (11.1%) deciding to outsource and eight (8.9%) dropping the process. The replacement options for the others are shown in Figure 25. Zinc plating was the most popular replacement, with zinc alloys also important.

Copper cyanide plating is the most popular of the cyanide-based plating baths with 164 shops reporting of which 117 (71.3%) continue to use the process. Of the others, six (3.7%) chose outsourcing and eight (4.9%) dropped the process. Replacement options selected by the remainder are shown in Figure 26, with acid copper and alkaline non-cyanide copper plating equally favored.

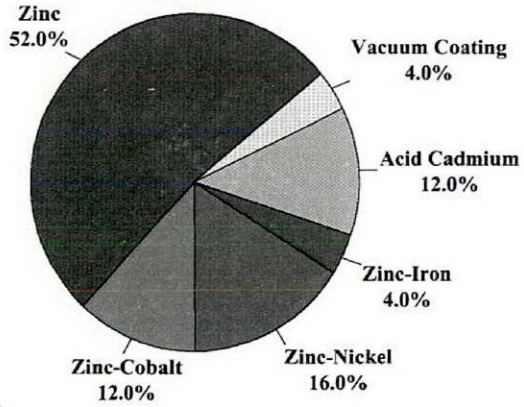
The last cyanide-based process for which information was collected was zinc cyanide plating. There were 104 responses received, of which 32 (30.8%) still use the process. Of the others, seven (6.7%) selected outsourcing and three (2.9%) chose to drop the process. The favored replacements for the rest of the shops are alkaline non-cyanide zinc and acid zinc as shown in Figure 27.

Figure 24. Elimination/Replacement of Processes Based on Cyanide



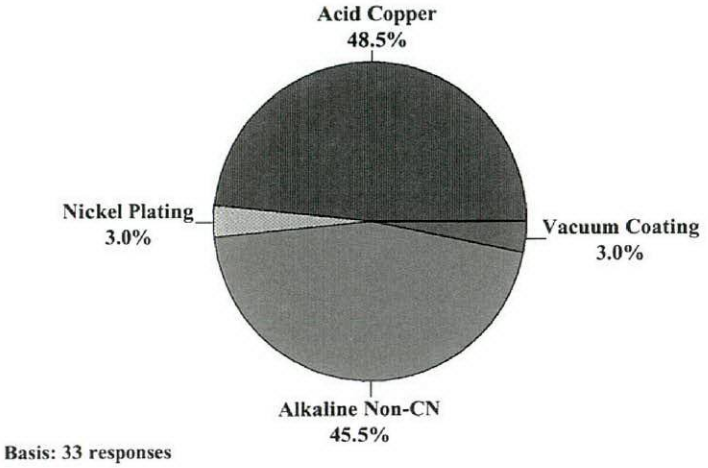
Basis: 108 captive and 228 job shop responses

Figure 25. Replacements for Cyanide Cadmium Plating



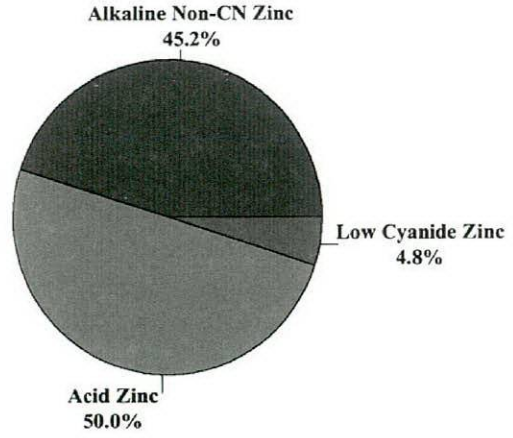
Basis: 25 responses

Figure 26. Replacements for Cyanide Copper Plating



Basis: 33 responses

Figure 27. Replacements for Cyanide Zinc Plating



Basis: 62 responses

FIRE PREVENTION

We inquired about the use of sprinkling systems in captive and job shop production facilities. There were responses from 256 job shops, of which 44.9% indicated that they did have a sprinkler system installed in their production facility. Of the 137 captive shops that responded 84.7% indicated that they had a sprinkler system installed in their facility. Both groups were asked why they installed the sprinkler system. Their responses are shown in Table 48. The totals do not add up to 100% because some respondents checked more than one reason. In addition, a few respondents indicated that they were gifted with a sprinkler system when they purchased/leased a facility.

Table 48. Reasons for Installing a Sprinkler System

	Captive Shops	Job Shops
Required by Insurer	65.5%	40.0%
Required by Government Agency	36.2%	30.4%
Voluntary	27.6%	50.4%

Basis: 116 (84.7%) of captive and 114 (44.9%) of job shops

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METAL FINISHING INDUSTRY MARKET SURVEY

REPORT NO. 7

Metal Finishing Trends In the Automotive Industry

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METAL FINISHING INDUSTRY MARKET SURVEY

REPORT NO. 7

Metal Finishing Trends In the Automotive Industry

This report is published under the auspices of the Surface Finishing Industry Council (SFIC) by the American Electroplaters and Surface Finishers Society (AESF), the Metal Finishing Suppliers' Association (MFSA), and the National Association of Metal Finishers (NAMF) as a service to the metal finishing industry and contains information based on input from companies in the industry. The information published in this report was developed from actual historical information and does not include any quantitative projected information.

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EXECUTIVE SUMMARY

In recognition of the need for statistical information on the metal finishing industry the Surface Finishing Industry Council (SFIC), the American Electroplaters and Surface Finishers Society (AESF), the Metal Finishing Suppliers' Association (MFSA), and the National Association of Metal Finishers (NAMF) jointly support the Surface Finishing Market Research Board (SFMRB). The board is composed of representatives of the sponsoring organizations, who meet to discuss methods to gather the data of interest, implement these methods, and then compile and report results.

This report is the seventh in a series. The initial report was completed in 1994, with subsequent reports published in 1995, 1997, 1998, 1999, and 2001. This report provides new information relating to metal finishing trends in the automotive industry.

Some of the key findings, which are further detailed in the text, tables, and figures of the report, are as follows:

- The automotive sector represents the largest market for metal finishing job shops and their suppliers.
- Automotive job shops and their finishing equipment and chemical suppliers consist primarily of experienced firms, with many certified to ISO 9000 or QS 9000 quality standards.
- The greatest challenge facing automotive job shops and automotive finishing equipment and chemical suppliers is pressure to lower prices.
- The East Central geographic region has the highest concentration of both automotive job shops and automotive finishing chemical and equipment suppliers in the United States.
- Zinc and nickel are the most popular plating processes provided by automotive job shops.
- The most popular new process automotive job shops plan to add to their services is zinc alloy plating with zinc-iron or zinc-nickel most frequently cited.
- The process most cited for elimination and replacement by automotive job shops and their suppliers is hexavalent-chromium-based conversion coatings.
- Both job shop finishers and their suppliers believe that aluminum and aluminum alloys are the automotive substrates most likely to grow in usage.
- Two out of three of the cadmium and zinc cyanide plating processes nationwide in automotive job shops have been eliminated and/or replaced.

Diskettes containing the data upon which this report is based (Microsoft Excel spreadsheet format) are available at an additional fee. SFMRB will also offer customized analyses and reports based on the data for a fee to be negotiated. (Minimum $500)

PURPOSE OF SFMRB

The metal finishing industry in North America has been faced with dramatic economic, technical, and regulatory challenges in recent decades. An industry under diverse pressures needs basic statistical information to know where it stands and to guide its future course. The Surface Finishing Market Research Board (SFMRB) was created in 1991 to meet this need.

SFMRB is managed by the Surface Finishing Industry Council (SFIC), which is funded and supported by the American Electroplaters and Surface Finishers Society (AESF), the Metal Finishing Suppliers' Association (MFSA), and the National Association of Metal Finishers (NAMF). The first two SFMRB reports, completed in 1993 and 1995, focused mainly on the status of the metal finishing industry. The third, fourth, fifth, and sixth SFMRB reports, completed in 1997, 1998, 1999, and 2001 also reported on the industry status, but in addition included data on ten areas of high interest to the sponsoring members.

The information in these reports is intended to help metal finishers, their suppliers, and end users make better decisions regarding areas for business development and provide the industry with more detailed information regarding employment and commercial activity for use in presentation to governmental and regulatory bodies. This year's survey revisited some of the topics surveyed in the past, and, where practical, compares the current data with that collected in prior surveys. This survey differs in that new data are included with a specific focus on the automotive industry.

METHODOLOGY

The SFMRB used mailing lists supplied by the industry associations (NAMF and MFSA) of their members. The lists were provided without rental charge. Two similar questionnaires were prepared, one for finishing job shops, represented by the NAMF members, and one for finishing process and equipment suppliers, represented by MFSA members. All members of both associations received a questionnaire. The questionnaires were designed to be anonymous, brief, and easy to fill out. Each questionnaire was sent with a covering letter and a dollar bill to further encourage participation.

SURVEY RESPONSE

Both surveys were mailed in late April of 2002 and were sent to the complete mailing list of NAMF, which totaled 704 members, and the complete mailing list of the MFSA, which totaled 170 members. Courtesy copies were also provided to the management offices of the NAMF affiliates. Questions were related to areas of interest to both finishers and suppliers, including sales volume, employment, involvement in the automotive industry, processes and equipment employed by NAMF members, processes and equipment marketed by MFSA members, hazardous process substitutions used by NAMF members, and environmentally friendly processes offered by MFSA members.

The response rate from both surveys is summarized in Table 1. The rates of response for both NAMF and MFSA members were very good. A comparison with past surveys conducted by SFMRB in recent years shows that typical response rates for job shops ranged from 16.4 to 25.5% compared to 30.4% in this survey. The response rate from suppliers was even higher at 41.2%. Considering the quality and quantity of the responses, SFMRB believes the values currently reported to be plus or minus 5 to 10% of reality.

Table 1. Response Rate to Surveys

	# Mailed	# Received	Response Rate
NAMF	704	214	30.4%
MFSA	170	70	41.2%

GENERAL INFORMATION

Basis of Report

Of the 214 job shops that responded to the survey, it was found that 44 had no sales involvement with automotive OEMs or the automotive aftermarket. These shops were not included in the results reported below. It was decided to define an automotive finishing job shop as one that has a minimum of 20% or at least $500,000 in annual sales devoted to automotive OEMs and/or the automotive aftermarket. There were an additional 56 shops that did not meet these criteria, leaving questionnaires from 114 job shops to serve as the basis of this report.

A similar refinement was made to the surveys returned by suppliers. An automotive finishing supplier was defined as one that has at least 10% of its sales devoted to automotive OEMs and/or the automotive aftermarket or a minimum of $1,000,000 annually in sales to these markets. A total of 52 suppliers qualified under these criteria, including 21 chemical manufacturers, 16 equipment manufacturers, and 15 distributors.

Significance of the Automotive Market

How important is the automotive industry to metal finishers? A brief summarization of the surveys tells us that 36% of job shop sales go to the automotive industry, combining the OEM and aftermarket sectors. Referring to the 1996-97 SFMRB report, the total job shop market is $16 billion. At this 36% rate, the automotive market for job shop finishers is in the neighborhood of $5.75 billion.

Members of the National Association of Metal Finishers are the leading finishing job shops in the U.S. and are dedicated to continue the high quality demanded by the automotive industry. According to the NAMF Membership Directory, 47% of the members nationwide do some work for the automotive sector.

The market for consumables used by the combined job shop and captive finishers would be approximately 46% of the reported $7 billion in GDP contribution reported in the 1996-97 SFMRB report survey or $3.2 billion. It must be remembered that these figures include sales to both job and captive finishers. Using the figure that 12% of the costs for finishers are for consumables, the total market for goods finished for the automotive sector would be 0.12 divided into $3.2 billion or $26.7 billion.

Facility Age

These data are based on responses from 114 automotive finishing job shops and 52 automotive finishing chemical and equipment suppliers. A job shop is defined as one that provides metal finishing services for a fee. It does not take ownership of the parts, but provides a service much as a dry cleaner handling garments. Of the 114 job shops, 91 have been in operation more than 25 years, 17 have been operating for 16 to 25 years, three for 11 to 15 years, two for 6 to 10 years, and one for 2 to 5 years. Comparable figures for the suppliers are 31 over 25 years, 10 for 16 to 25 years, five for 11 to 15 years, three for 6 to 10 years, two for 2 to 5 years, and one for less than 2 years.
This indicates a mature, experienced industry.

Plant Locations

Table 2 displays the responses broken down by percentage of job shop plant sites for each of eight U.S. regional areas (see Figure 1) and compares them with a previous survey taken in the Fall of 2000 for a universal group of job shops. It can be seen that the automotive finishing job shops are more likely to be located in the East Central region, which includes Michigan, Indiana, and Ohio, and less likely to be located in New England, Northwest, Southeast, or Southwest. The survey confirms that the Midwest has the highest concentration of job shops, with over 50% of the automotive finishers located in either the East or West Central regions.

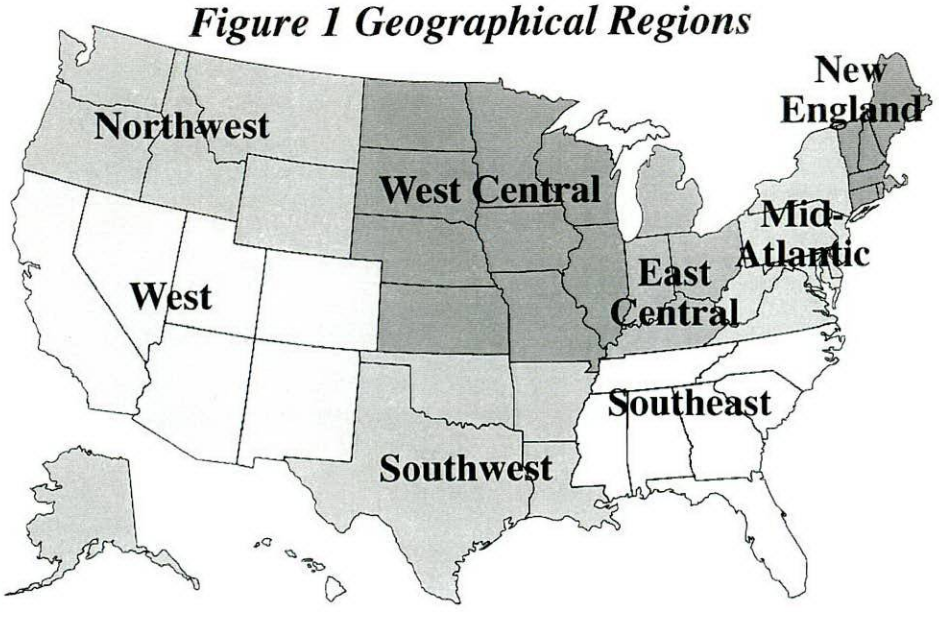
Table 2. Job Shop Plant Locations All Shops vs. Automotive Shops

Region	All 1998	All 2000	Auto Only 2002
New England	6.7%	9.5%	4.5%
Mid-Atlantic	13.5%	13.8%	16.1%
Southeast	7.3%	8.3%	4.5%
East Central	19.7%	19.0%	30.4%
West Central	23.0%	20.9%	20.5%
Southwest	6.7%	7.9%	0%
West	19.1%	17.4%	21.4%
Northwest	3.9%	3.2%	2.3%

Table 3. Plant Locations of Automotive Finishing Suppliers

Region	All Suppliers
New England	10%
Mid-Atlantic	13%
Southeast	10%
East Central	31%
West Central	12%
Southwest	2%
West	6%
Northwest	2%

Figure 1 Geographical Regions



The locations for the automotive finishing suppliers responding to the questionnaire are listed in Table 3. Once again the East Central area has the greatest concentration with 31%. There were a number of suppliers reporting from outside the United States (15%). These were primarily located in Canada.

Employment

Employment levels for automotive finishing suppliers and job shops are provided in Table 4 by the percentage of companies in each of 10 size categories. The data indicate a median of 40 and an average of 73 job shop employees per facility. This compares to a median of 17 and an average of 50 job shop employees from a universal study of all job shops in the Fall 2000. Automotive job shops are, on average, obviously larger than job shops serving other market sectors.

Table 4. Number of Employees in Automotive Finishing Job Shops and Finishing Supply Facilities

Range	Job Shops	Suppliers
1-2	0%	2%
2-5	2.7%	11.5%
6-10	8.0%	13.5%
11-20	16.1%	21%
21-30	7.1%	19%
31-50	17.0%	6%
51-75	12.5%	7.5%
76-100	13.4%	6%
101-200	17.0%	7.5%
Over 200	6.3%	6%

Note that the median is taken as the number of employees for the shop in the middle of the range, for example the third shop in a ranked list of five; while the average is the sum of all employees for all shops divided by the number of shops. For example for this set of values:

< 3 - 20%
3-5 - 30%
5-8 - 40%
> 8 - 10%

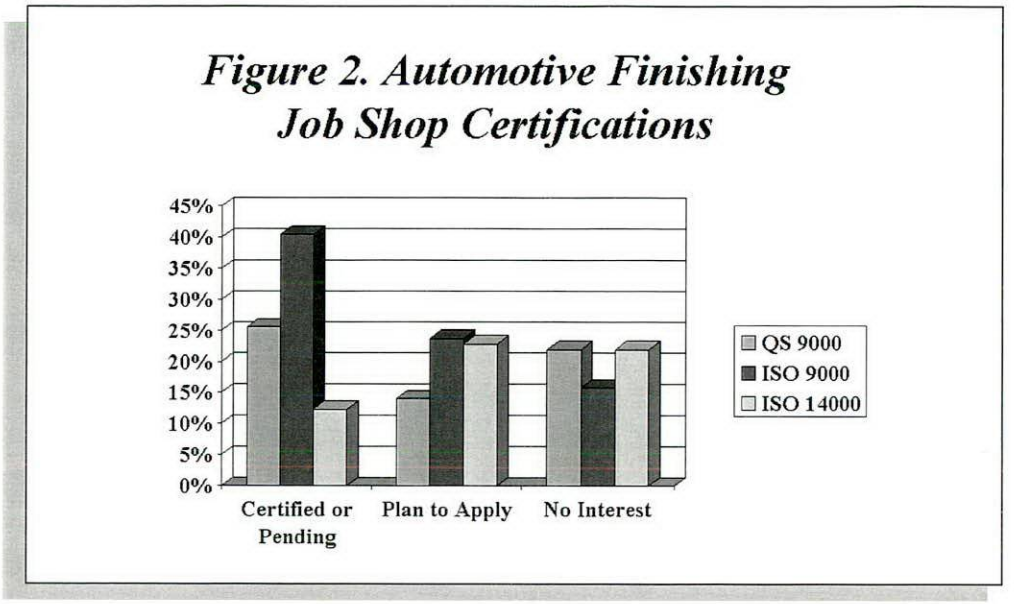
The average = 1.5 x 0.2 + 4 x 0.3 + 6.5 x 0.4 + 9.5 x 0.1 = 5.05

There is a median of 22 and an average of 48 supplier employees per firm. The suppliers were further broken down into three major categories including 21 chemical manufacturers, 16 equipment manufacturers, and 15 distributors. The average employment varied considerably by category. The chemical manufacturers were the largest with a median of 28 and an average of 65 employees, the equipment manufacturers had a median of 25 and average of 57 employees, and the distributors had a median of 10 and an average employment of 14.

Quality and Environmental Certifications

In order to determine the level of participation/interest in quality and environmental certifications, respondents were asked about their status regarding ISO 9000, QS 9000, and ISO 14000. The surveys indicate that the majority of both automotive finishers (64.1%) and suppliers (52.4% of chemical manufacturers; 73.4% of distributors; and 56.3% of equipment manufacturers) are either certified, in the application process, or plan to obtain certification to either ISO 9000 or QS 9000 quality standards.

Many finishers (35.1%) are also certified or plan to obtain certification to ISO-14000, an environmental management system; however, suppliers have far less interest in pursuing ISO-14000 certification. See Figures 2 to 5.



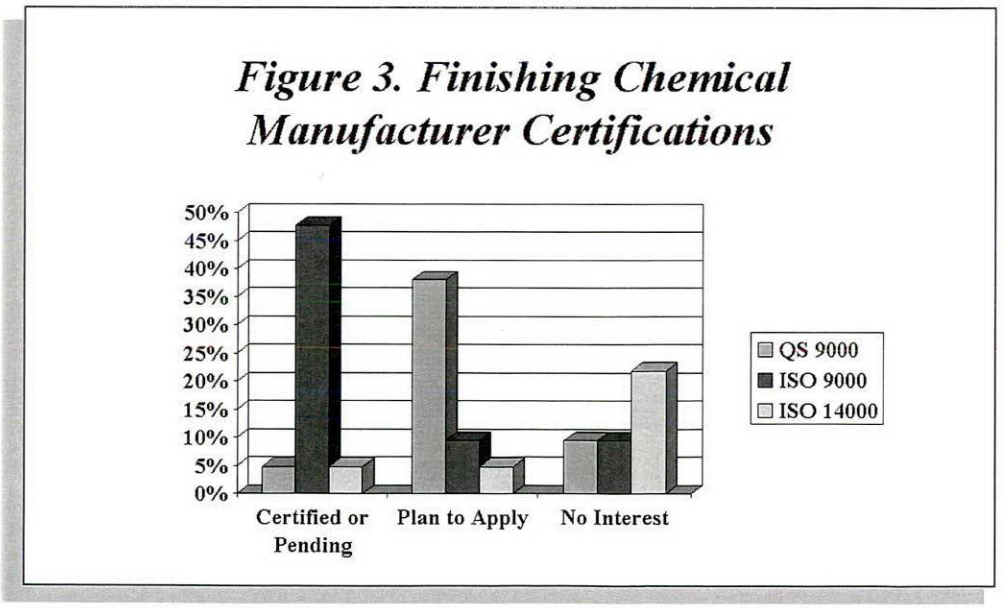


Figure 4. Finishing Equipment Manufacturer Certifications

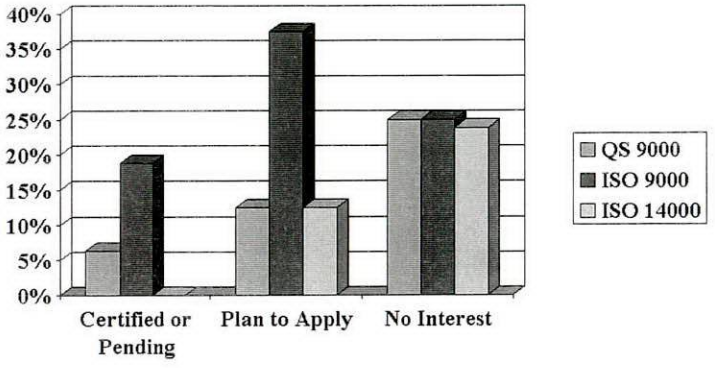
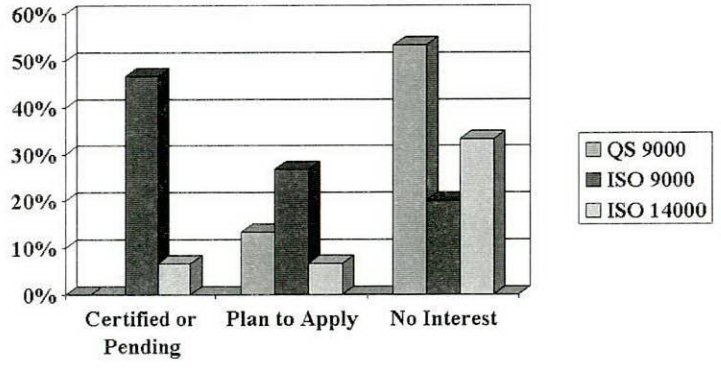


Figure 5. Finishing Distributor Certifications



SALES VOLUME AND TRENDS

Sales Volumes

The sales volumes for the 114 automotive finishing job shops that responded are summarized in Table 5 The median automotive job shop sales volume was $4.8 million (vs. $2.2 million for all shops in 2000) with the average sales $6.7 million (vs. $4.8 million for all shops in 2000). The percentage of automotive oriented job shops in the upper ranges (above $15 million) was much higher than in previous surveys, reflecting the fact that automotive job shops tend to be much larger than the overall metal finishing industry job shop average. These data also confirm the higher number of employees noted in the upper ranges, as reported above.

Table 5. Sales Volume of Job Shops

$ Millions	1997	1998	2000	Auto 2002
< 0.25	8.7%	11.6%	10.0%	0
0.25-0.499	11.0%	8.7%	6.2%	2.6%
0.50-0.999	15.6%	18.6%	13.5%	9.7%
1-1.999	22.1%	21.5%	18.5%	13.2%
2-2.999	13.3%	7.6%	12.4%	14.0%
3-4.999	12.9%	9.9%	11.6%	11.4%
5-6.999	5.3%	9.9%	6.6%	19.3%
7-9.999	5.3%	5.2%	6.2%	8.8%
10-14.999	3.4%	4.1%	6.9%	7.0%
15-20	1.2%	1.7%	2.7%	7.0%
> 20	1.2%	1.2%	5.4%	7.0%

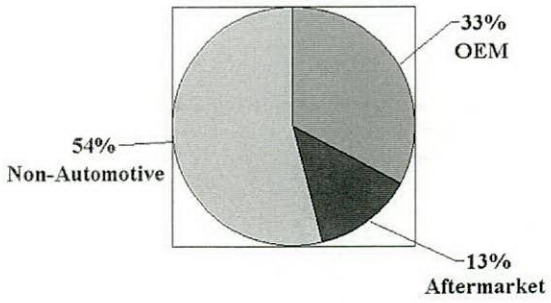
The average sales revenue for job shops from past surveys has ranged from $2.5 million to $3.6 million, with revenue per employee ranging from $75,000 to $96,000. The current job shop data indicate an average of $92,000 in sales revenue per job shop employee.

Automotive-Related Sales

There were 114 selected automotive job shops, adding the 56 that are minimally involved, we arrive at the grand total of automotive sales from the respondents to the survey. They reported a total of $1.05 billion in total sales with $379 million (36%) to the automotive industry. The sales were split as 23% to the OEM and 13% to the aftermarket segments. Based on data from past surveys, total job shop metal finishing sales to the automotive industry are approximately $3.5 billion annually. Thus, responders to this survey handle about 30% of the job shop finishing sales to the automotive industry.

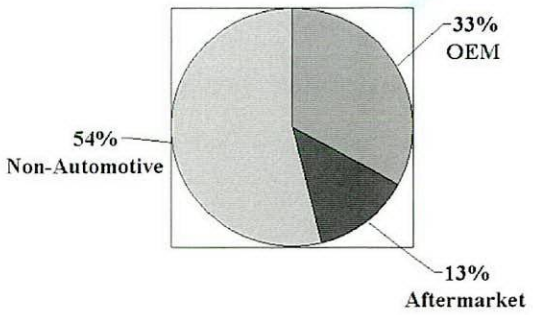
The 25 chemical manufacturers that participated in the survey reported $234 million in total sales with $108 million (46%) to the automotive sector. These sales were split as 33% to the OEM and 13% to the aftermarket segments (see Figure 6). Past SFMRB survey data indicate that automotive metal finishing chemical sales are in the $1.4 to $1.5 billion range. Thus, nearly 15% of automotive finishing chemical sales are handled by the responders to this survey, not including sales through distributors. This is indicative as to how important this market is to the U.S. metal finishing industry chemical suppliers.

Figure 6. Finishing Chemical Supplier Market Segments



Finally, the 15 distributors participating in the survey reported $142 million in total sales with $55 million (39%) to the automotive industry. This included 22% to the OEM segment and 17% to the aftermarket segment as shown in Figure 7.

Figure 7. Finishing Distributor Market Segments



Sales Trends

The finishing job shops and finishing suppliers were questioned about their automotive sales volume compared to 5 years ago. Table 6 provides a comparison of sales today with those of five years ago for each of the four groups of respondents for both the automotive OEM and aftermarket segments. The automotive finishing job shops had the least improvement in the OEM market with over half indicating lower sales or no change over the five-year period. All the other groups had at least half of the respondents indicate that sales volume was slightly or substantially better over the five year time span with chemical suppliers having 75% of their respondents in the OEM market segment showing improved sales.

A majority of the respondents in all groups showed improvement in sales volume for the automotive aftermarket segment with chemical suppliers in the lead at 69% and distributors trailing the others with 53% showing improvement but 31% having a decline.

Table 6. How Did Long-Term (5-Year's Ago) Automotive Finishing Sales Compare to Today

OEM Market	Much Worse Now	Slightly Worse Now	Even	Slightly Better Now	Much Better Now
Job Shops	7%	8%	38%	20%	26%
Chemical Suppliers	0	20%	5%	35%	40%
Equipment Suppliers	14%	14%	21%	14%	36%
Distributors	8%	15%	15%	23%	38%
Aftermarket	**Much Worse Now**	**Slightly Worse Now**	**Even**	**Slightly Better Now**	**Much Better Now**
Job Shops	5%	6%	31%	40%	19%
Chemical Suppliers	0	21%	10%	53%	16%
Equipment Suppliers	13%	13%	13%	33%	27%
Distributors	0	31%	15%	38%	15%

Table 7 provides the automotive sales forecasts of the finishing job shops and finishing suppliers for the long term (5 years). All four groups are optimistic on average with near 60% or more forecasting increases. This may reflect the rosy outlook for the automotive sector at the time the survey was taken (Spring 2002). The most optimistic are the chemical suppliers with 77% expecting a sales increase in the automotive OEM market and 81% expecting an increase in the automotive aftermarket segment.

Table 7. Future Long-Term (5-Year) Automotive Finishing Sales Forecasts

OEM Market	Large Decrease	Slight Decrease	Even	Slight Increase	Large Increase
Job Shops	6%	7%	25%	35%	28%
Chemical Suppliers	5%	5%	14%	48%	29%
Equipment Suppliers	13%	6%	19%	31%	31%
Distributors	7%	0	36%	36%	21%
Aftermarket	**Large Decrease**	**Slight Decrease**	**Even**	**Slight Increase**	**Large Increase**
Job Shops	5%	6%	31%	40%	19%
Chemical Suppliers	0	10%	10%	52%	29%
Equipment Suppliers	7%	7%	27%	27%	38%
Distributors	8%	8%	23%	38%	23%

The extended data of Tables 6 and 7 were averaged and the results are presented in Table 8. The data from the first two columns indicate that the chemical manufacturers clearly enjoyed far better growth over the preceding five years than did the equipment suppliers. Part of the explanation for this may be a general overcapacity in the market, so while increases in business mean increased chemical consumption, equipment utilization increases without the need for adding capacity in line with growth. Mothballed equipment can be put back on line and a large inventory of used equipment can be sold and activated without showing up in the figures reported.

It should be noted that the data in Tables 6 and 8 may have been affected by the awkward wording of the question concerning sales today versus five ago.

The final two columns of Table 8 provide a forecast of economic conditions for the long term. In this case the question specifically requested annual growth rates for a five-year period. All four groups are generally optimistic with the chemical suppliers having the largest growth and distributors the lowest. Once again it should be observed that the survey was taken in April and May of 2002 and may reflect the positive outlook at that time for the automotive market in general.

Table 8. Growth in Sales Volume for the Last 5 Years and Projected Growth Rate for the Next 5 Years

	Automotive OEM Market 5 Years Ago to Today	Automotive Aftermarket 5 Years Ago to Today	Automotive OEM 5-Year Annual Growth Rate Forecast	Automotive Aftermarket 5-Year Annual Growth Rate Forecast
Job Shops	6.7%	3.8%	3.3%	2.7%
Equipment Suppliers	4.6%	6.3%	3.0%	2.9%
Chemical Suppliers	13.8%	9.2%	4.0%	4.6%
Distributors	10.4%	3.5%	2.1%	2.2%

AUTOMOTIVE JOB SHOPS

Plating Processes Employed

The survey requested information on 25 electroplating processes and 6 electroless plating processes employed by job shops. Data were collected and the most frequently mentioned are reported in Table 9 as the percentage of shops using each process. Zinc and nickel electroplating processes are the highest reported with over 50% of the automotive job shops having them in use. Copper and zinc alloy electroplating processes are utilized by more than one-third of these job shops while 30% have lines for decorative chromium electroplating and electroless nickel plating. Note that the percentages do not add up to 100% because most respondents are engaged in more than one process.

Surface Treatment Processes Employed

In addition to seeking information on plating processes, data were also sought for 24 related metal finishing treatment processes. Those most frequently reported in use are listed in Table 10. Processes for chromate conversion coating, phosphating, and stainless steel passivation were the most widely used, each reported by 30% of the shops. About 25% reported use of buffing/polishing and bright dipping while about 20% use Type II (sulfuric acid) anodizing and blackening processes.

Table 9. Most Popular Plating Processes Used in Automotive Job Shops	
Zinc	54.4%
Nickel	51.8%
Copper	37.7%
Zinc Alloys	36.0%
Decorative Chromium	29.8%
Electroless Nickel	29.8%
Tin	27.2%
Cadmium	15.8%

Table 10. Most Popular Surface Treatments Used in Automotive Job Shops	
Phosphating	32.5%
Chromating	32.5%
Stainless Steel Passivation	30.7%
Bright Dipping	24.6%
Buffing and Polishing	23.7%
Blackening	20.2%
Type II Anodizing	19.3%
Type III Anodizing	14.0%

Systems and Equipment Employed

The automotive job shops were asked to indicate the types of equipment they have that are available for the processing of automotive parts. Five types of systems were noted; namely, hand lines, manual hoists, automated hoists, automated return-type machines, and reel-to-reel strip plating machines. A further question asked whether systems in the first four groups were rack, barrel, or a combination of both. The results are shown in Figures 8 to 12 for the 107 shops that responded to these questions.

The split between manually operated and automated systems is shown in Figure 8. (Note that the key to the pie-shaped graphs in this series begins in the upper right and proceeds clockwise). It can be seen that 32% of the systems are hand lines and an additional 30% are manual hoists. Thus more than 60% of the systems are manually operated and less than 40% are automated. This is not surprising since job shops require a degree of flexibility in their operations.

Figure 9 gives the split between rack, barrel, combination rack/barrel, and reel-to-reel machines. A further breakdown for rack, barrel, and combination rack/barrel systems is provided in Figures 10 to 12. Systems employing barrels alone were the most likely to be automated (44%). An average of 2.8 types of systems were offered per facility.

Figure 8. Extent of Automation in Automotive Finishing Job Shops

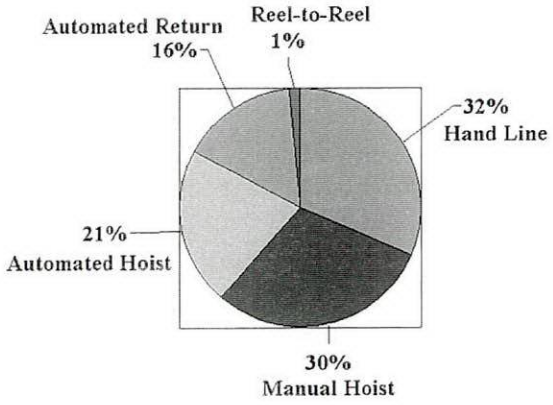


Figure 9. Types of Systems Used in Automotive Finishing Job Shops

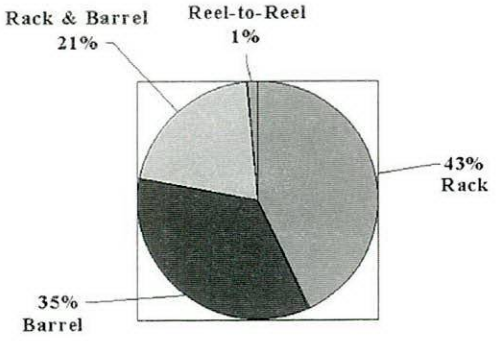


Figure 10. Rack Systems Used in Automotive Finishing Job Shops

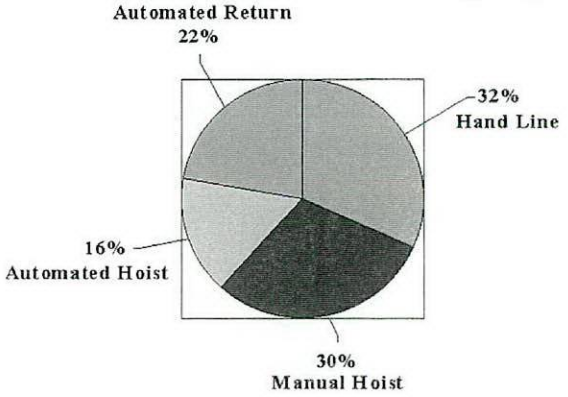


Figure 11. Barrel Systems Used in Automotive Finishing Job Shops

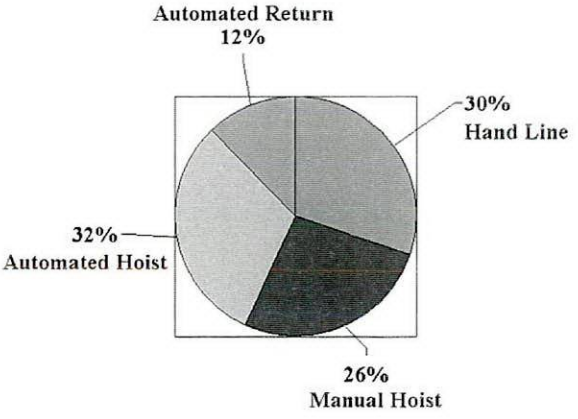
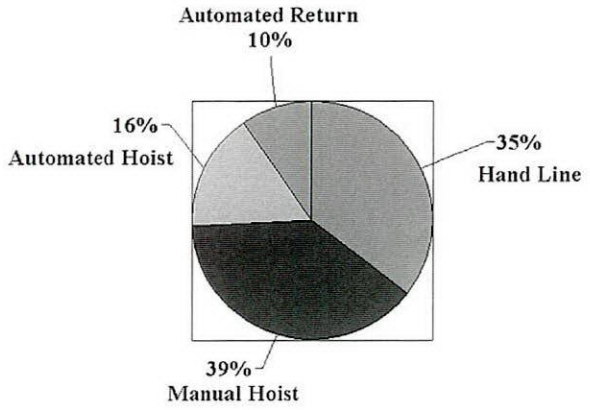


Figure 12. Combination Rack/Barrel Systems Used in Automotive Finishing Job Shops



CHEMICAL AND EQUIPMENT MANUFACTURERS

Plating Processes Offered

The ten plating processes most frequently offered by the 21 chemical manufacturers responding to the survey are listed in Table 11. The four with the highest response rates were nickel, zinc, and zinc-iron alloy electroplating and electroless nickel plating, each provided by more than half of the suppliers. Next highest in frequency were zinc-nickel alloy, tin, copper, and zinc-cobalt alloy electroplating processes offered by about 40% or more.

Table 11. Plating Processes Most Frequently Offered by Chemical Manufacturers

Nickel	57%
Zinc	52%
Zinc-Iron	52%
Electroless Nickel	52%
Zinc-Nickel	48%
Tin	43%
Zinc-Cobalt	38%
Copper	38%
Decorative Chromium	33%
Hard Chromium	33%

Surface Treatment Processes Offered

The ten most frequently offered surface treatment processes by the 21 chemical manufacturers responding to the survey are listed in Table 12. The two with the highest response rate were chromate conversion coatings and cleaning materials, each provided by more than 50% of the chemical suppliers. Next highest in frequency were phosphating, nonchromate conversion coatings, and blackening processes, offered by one-third or more of the suppliers.

Table 12. Surface Treatment Processes Most Frequently Offered by Chemical Manufacturers

Chromate Conversion Coatings	57%
Cleaning Materials	52%
Phosphates	38%
Blackening	33%
Nonchromate Conversion Coating	33%
Bright Dipping	29%
Metal Stripping	29%
Electropolishing	29%
Paint Stripping	19%
Etching	19%

Systems and Equipment Offered

The types of plating/anodizing systems supplied by equipment manufacturers for finishing of automotive parts that are available from a high percentage of the 15 automotive equipment suppliers that responded are shown in Table 13.

Table 13. Systems Available from Finishing Equipment Suppliers

Systems Available	Rack	Barrel	Strip/Coil
Hand Line	47%	53%	
Manual Hoist	53%	47%	
Automated Hoist	60%	67%	
Automated Return	27%	13%	
Reel-to-Reel			20%

The types of equipment components offered by these same automotive finishing suppliers are as shown in Table 14. Most widely available are heaters/chillers, tanks and liners, racks/barrels/baskets, air pollution control devices, and waste treatment systems.

Table 14. Components Offered by Finishing Equipment Suppliers

Air Pollution Control	63%		Parts Washers	25%
Anodes, insoluble	19%		Power Supplies	56%
Conveyors/Hoists	44%		Racks/Barrels/Baskets	63%
Dip/Spin Coating	6%		Recycling/Recovery	38%
Filters/Pumps	63%		Tanks/Tank Liners	63%
Heaters/Chillers	69%		Waste Treatment	63%
Painting/Powder Coating	13%			

Sixteen manufacturers of plating/anodizing equipment completed this part of the survey. Many reported as being suppliers of more than one of the product categories listed. In fact, the median number of product lines was 5.3. This counts all hoist lines, whether manual or automatic, and whether rack or barrel or both, as a single product line. Most of the total of 10 companies reporting as suppliers of systems reported that they were able to supply either rack or barrel, automated or manual hoists. Fewer (4) were able to supply return-type machines.

FINISHING DISTRIBUTORS

Processes and Equipment Offered

There were 15 automotive finishing chemical and equipment distributors who responded to our survey. Many offer finishing chemicals, anodes, systems, and equipment. The following five tables summarize the broad range of materials and equipment offered by these focused distributors and the percentage of distributors offering each category.

Table 15 is a listing of the electroplating processes most frequently offered by distributors. The popularity of the chemicals offered is somewhat indicative of the use rate by the automotive industry.

Table 15. Electroplating Processes Most Frequently Offered by Distributors

Decorative Chrome	67%
Nickel	67%
Copper	60%
Tin	60%
Zinc	60%
Nickel alloy	53%
Tin-Lead	53%
Cadmium	47%
Hard Chrome	47%
Zinc-Nickel	47%
Brass	33%
Cobalt	33%
Tin-Nickel	33%
Tin-Zinc	33%
Zinc-Cobalt	33%
Zinc-Iron	33%
Tin-Cobalt	20%

Table 16 lists the electroless and immersion plating processes most frequently available from automotive distributors and Table 17 lists the most frequently available chemicals from automotive distributors for various surface treatment processes.

Table 16. Electroless and Immersion Plating Processes Most Frequently Offered by Distributors

Nickel	73%
Tin	27%
Copper	27%

Table 17. Surface Treatment Processeses Most Frequently Offered by Distributors

Conversion coating (chromate)	67%
Cleaning	60%
Conversion coating (nonchromate)	60%
Electropolishing	53%
Phosphating	53%
Blackening	47%
Metal stripping	47%
Stainless steel passivation	47%
Waste treatment chemicals	47%
Etching	40%
Anodizing Type II	33%
Anodizing Type III	33%
Bright dipping	33%
Mechanical finishing	33%
Anodizing Type I	27%
Antiquing	27%
Buffing/polishing	27%
Paint stripping	27%

Table 18 summarizes the plating and anodizing systems available from the automotive finishing distributors. It is obvious that those who offer this type of equipment, can offer almost all the versions.

Table 18. Plating and Anodizing Equipment Systems Offered by Distributors

Hand line,rack	53%
Hand line,barrel	53%
Manual hoist,rack	53%
Manual hoist,barrel	53%
Automated hoist,rack	53%
Automated hoist,barrel	53%
Automated return-type, rack	47%
Automated return-type, barrel	27%
Reel-to-reel	27%

The various equipment components offered by these distributors, other than plating/anodizing systems, is listed in Table 19.

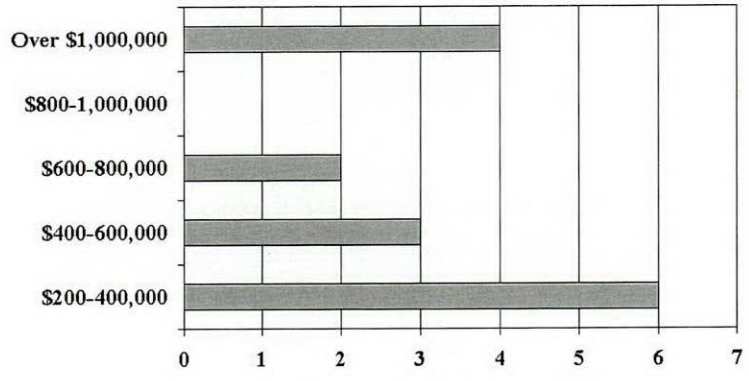
Table 19. Equipment Components Offered by Distributors

Waste treatment	60%
Filters/pumps	53%
Heaters/chillers	53%
Parts washers	53%
Rack/barrels/baskets	53%
Tanks,liners	53%
Air pollution control	47%
Insoluble anodes	47%
Recycling/recovery	47%
Power supplies	40%
Conveyors/hoists	33%

Types of Distributors

Sales per employee for distributors resulted in a mean of slightly over $600,000. It was clear from the data; however, and no surprise to the committee, that distributorships can take many different forms. The product mix handled, as well as the level of service provided with the product, can greatly affect the data reported. As an example, a distributor handling largely anodes and commodity chemicals, generally considered to be high dollar volume but low margin items, would be expected to have a much higher level of sales dollars per employee, compared to a distributor whose product line is primarily proprietary chemicals. With those, the distributor would generally be adding people-intensive services, such as laboratory analyses and field service, while enjoying a larger gross margin on the products to offset these costs. Equipment would be expected to fall in between these two extremes. Finally, many of the companies reporting, while classifying themselves as distributors, are believed to be manufacturers of at least a portion of their product line. To the degree that this is inconsistent from one company to another, this further complicates and distorts the comparisons. The distribution of the data is reflected in Figure 13.

Figure 13. Sales Volume per Employee for Automotive Finishing Distributors



PROCESS TECHNOLOGY TRENDS

Methodology

In the survey, each firm was asked to indicate whether each of the automotive processes currently in use at their facility was expected to change over the next five years. Three points were assigned if a large increase was shown, one point for a small increase, none for "stay the same", minus one for a small decrease, and minus three for a large decrease. Since there were different numbers of responders for each finish, weighted averages were used to be able to compare the number of points and, therefore, trends for each finish. Please note that each survey was weighted equally; therefore, the response from a minor player in a market is weighted equally with a potential market leader.

Trends for Job Shops and Suppliers

Questions regarding anticipated technology trends resulted in an unexpected variance between job shops, distributors, and chemical manufacturers. In general, the job shops reported a higher degree of optimism for most finishes than did either the chemical manufacturers or the distributors. In some cases, such as tin-lead, the job shop finishers saw expansion, while the chemical manufacturers, and in some cases the distributors, anticipated contraction of the market. Conversely, the chemical manufacturers predicted a substantial increase in hard chromium plating, while the job shops indicated an expected decline. In many of the product categories, the number of distributors reporting was too small to be statistically significant.

All groups saw the largest increase to be in nonchromate conversion coatings. On a weighted average basis, among those other categories with a significant number reporting, the job shop finishers perceived the greatest area for percentage growth to be tin-zinc, followed by zinc-iron, zinc-nickel, nickel alloys, and tin-nickel.

On the other hand, the suppliers saw the opportunities in the following areas after nonchrome conversion coatings: zinc, tin-zinc, electroless nickel, nickel alloys, zinc-iron, and zinc-nickel. Distributors listed zinc, zinc-nickel, and tin-zinc, as having the greatest opportunities among plated finishes. Among nonplated finishes, those rated with the greatest opportunities by the job shop finishers were dip painting, powder coating, spray painting, mechanical plating, and buffing and polishing; by the suppliers only blackening was consistently mentioned; and by the distributors no specific technology appeared consistently. It must be noted that some of these finishes are largely purchased from suppliers who may not have been included in the database used for mailing of questionnaires to the suppliers.

On the flip side, only cadmium plating and chromate conversion coatings were seen to have a very significant decrease in the future by all groups. Additionally, the following areas were perceived as having the greatest future weaknesses in the market: by the job shops—brass; by the suppliers no particular area stood out; by the distributors—tin-lead.

Curiously, despite the clear and strong trend toward the use of nonchrome containing conversion coatings, this was not totally reflected in the responses concerning chromate conversion coatings. While the predictions for a drop in the use of chromate conversion coatings were shown by all three groups, the magnitude of expected change was not consistent with the growth of nonchromate finishes. This could indicate that despite the change by many finishers from chromate to nonchromate, the overall growth expected in the zinc and zinc alloy markets will offset much of the loss of chromate business to the alternative finishes. Also, many of the job shops indicated that they were both replacing and continuing to use chromate conversion coatings. This would seem to imply that certain of their customers requested or approved the change from chromated to nonchromated coatings, while other of their customers were resisting or had not yet approved the substitution.

Overall, the data may be confounded by all the mixed signals and confusion surrounding the ELV over the past year. The ELV, end of life vehicle, concerns the requirement to recycle automobiles. The presence of hexavalent chromium hinders these efforts and the European Community issued mandates to limit the amount of hexavalent chromium that could be used on vehicles. The effective date of the mandate was extended to 2007 after the surveys were mailed. Also, some of the replacements proposed are trivalent chromium based materials. It is possible that further confusion relates to the fact that trivalent chromium in not "nonchromium."

AUTOMOTIVE SUBSTRATES

Job Shop Usage

The top six automotive substrates, in terms of percentage of shops engaged in processing them, are listed in the first column of Table 20. The carbon steels are the most frequently mentioned with aluminum and stainless steel next in usage. The last two columns of the table give the average and median percentages in use for each substrate. Thus, for aluminum, 32.4% of the shops process the metal with an average usage at 47.3% and a median usage at 40%.

Table 20. Substrates Processed in Automotive Finishing Job Shops

Substrate	Number Processing	Average Load	Median Load
Aluminum	32%	47%	40%
Copper/Brass/Bronze	13%	29%	20%
Stainless Steel	29%	17%	10%
Low Carbon Steel	74%	59%	60%
High Carbon Steel	43%	32%	25%
Zinc	17%	20%	13%

An average of 2.2 substrates are processed per job shop. Some shops are sharply focused on one substrate (80+%). For example, 30% of the job shops focus on aluminum and 38% on low carbon steel.

Methodology for Substrate Growth

Respondents were given a list of substrates currently in use for automotive applications and asked to indicate whether each is expected to increase in use, drop off in use, or remain the same for the next 5 years. Respondents were required to mark the appropriate box next to each substrate. These data from each reporting group were weighted and graphed to show relative growth projections for each substrate.

Numerical values were applied to each checked box as follows: "Big Decrease" = (-3); "Small Decrease" = (-1); "Stay the Same" = (0); "Small Increase" = (+1); "Large Increase" = (+3). Values were then tabulated to give relative growth projections. Tables 21 to 23 show the growth projections from each reporting group.

Substrate Growth Projections

The use of aluminum/aluminum alloy substrates topped the charts for growth projections by both finishers and suppliers (chemical manufacturers and distributors). Other substrates projected to grow by all groups included nickel/nickel alloys, magnesium/magnesium alloys, and stainless steel. Finishers and suppliers both felt that the use of copper/brass/bronze will likely decline.

Chemical suppliers project that the use of both high and low carbon steel will decline, whereas finishers project significant growth for steel. Chemical suppliers and distributors project a decline in zinc and white metal, but job shop finishers expect to see moderate growth.

Notes:
1) The number of responses from distributors on this subject was insufficient for comment.
2) Responses regarding various plastic substrates were insufficient for comment.

Table 21. Substrate Growth Projections by Job Shops

Significant Growth	Moderate Growth	No Change	Moderate Decline	Significant Decline
Steel (low carbon) Aluminum and alloys Steel (high carbon) Stainless steel	Zinc/white metal castings Magnesium and alloys Nickel and alloys	Ceramics/glass Titanium and alloys Circuit boards	Copper/brass/ bronze	Cast iron

Table 22. Substrate Growth Projections by Finishing Chemical Suppliers

Significant Growth	Moderate Growth	No Change	Moderate Decline	Significant Decline
Aluminum and alloys Circuit boards Nickel and alloys	Stainless steel	Cast iron Ceramics/glass	Titanium and alloys Copper/brass/ Bronze Steel (high carbon)	Zinc/white metal castings Steel (low carbon)

Table 23. Substrate Growth Projections by Finishing Distributors

Significant Growth	Moderate Growth	No Change	Moderate Decline	Significant Decline
Aluminum and alloys Nickel and alloys Magnesium and alloys	Stainless steel Titanium and alloys	Ceramics/glass Steel (low carbon) Steel (high carbon)	Copper/brass/ bronze Circuit boards	Cast iron Zinc/white metal castings

CHALLENGES FACED

Methodology

Respondents were given a list of likely challenges and asked to pick the "greatest", "the second greatest," and the "third greatest" challenges facing their companies. Survey results were weighted and ranked using the methodology described below.

Numerical values were applied to each ranked challenge as follows: "Greatest Challenge" = (5); "Second Greatest Challenge" = (3); "Third Greatest Challenge" = (1). Values were then tabulated to give relative rankings for each group.

Challenges Facing Finishers and Suppliers

The results of the tabulation using the numerical rankings are shown in Table 24. In general, challenges are similar for job shop finishers and their suppliers. Pressure to lower prices ranks as the greatest or close second greatest challenge for each group. All groups also see a major challenge in business moving offshore.

Table 24. Challenges Facing Finishers and Finishing Suppliers

Ranking for Job Shops			**Ranking for Chemical Manufacturers**	
#1 (59)	Pressure to lower prices		#1 (32)	Development of environmentally friendly finishes
#2 (410	Environmental compliance		#2 (30)	Pressure to lower prices
#3 (37)	Business moving offshore		#3 (22)	Business moving offshore
#4 (20)	Improving quality		#4 (8)	Environmental compliance
#5 (15)	Elimination of various finishes		#5 (5)	Improving quality
Ranking for Distributors			**Ranking for Equipment Manufacturers**	
#1 (27)	Pressure to lower prices		#1 (23)	Pressure to lower prices
#2 (15)	Business moving offshore		#2 (17)	Business moving offshore
#3 (10)	Development of environmentally friendly finishes		#3 (8)	Finding trained/qualified employees
#4 (10)	Globalization of the supply chain		#4 (6)	Globalization of the supply chain
#5 (6)	Finding trained/qualified employees		#5 (4)	Tightening specifications

In addition to price pressure and the effects of globalization, finishers face challenges due to environmental regulations and quality issues; however, issues relating to worker safety rules and tightening specifications are not viewed as problematic by finishers.

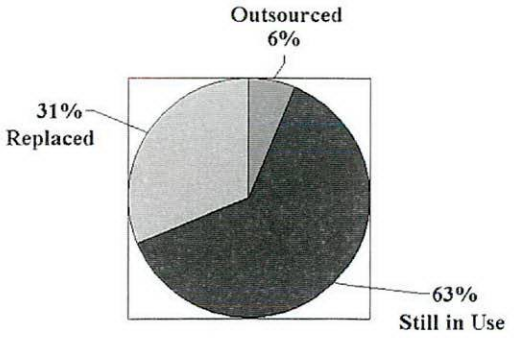
HAZARDOUS PROCESS SUBSTITUTION

Automotive job shops were requested to submit data on the substitution and/or elimination of processes considered hazardous. These include those using hexavalent chromium, cyanide, and lead. Data were also requested on decorative nickel, which has been implicated in allergic reactions for jewelry and similar products.

Solutions Based on Hexavalent Chromium

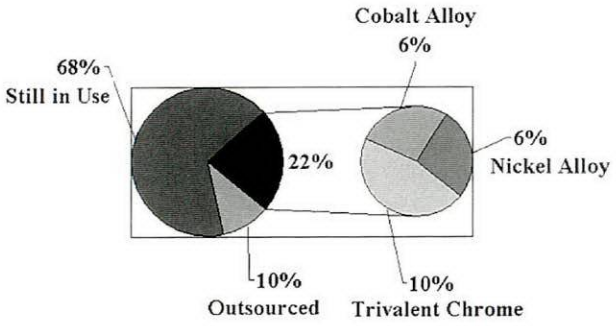
Figure 14 summarizes the results from job shops for four processes utilizing hexavalent chromium. These include decorative and hard chromium plating, chromate conversion coating, and chromic acid bright dipping of brass and copper. Indicated is the percentage of shops that continue to use the process (63%), those that have outsourced the process (6%), and those that have replaced it (31%). Details on each process are discussed below.

Figure 14. Summary for Automotive Finishing Processes Based on Hexavalent Chromium



The first solution considered was decorative chromium plating, using a chromic acid bath. There were 49 responses to this question. Of this number, 33 (68%) still use the process. Of the remaining 16, there were five (10%) who chose to outsource. The choices of the 11 who selected replacements are shown in Figure 15. Trivalent chromium plating is the primary replacement technology with cobalt and nickel alloys also viable alternatives.

Figure. 15 Decorative Hexavalent Chromium Plating Substitutes



A total of 22 shops responded to the question relating to hard chromium plating from a chromic acid bath. Of these, 12 (55%) continue to use the process. Four outsource the process. Six reported replacements. Of these five chose electroless nickel plating and one chose a nickel alloy plating process.

By far the most popular process within this group is chromate conversion coating, with 87 shops responding to this question. Of these, 50 (57%) continue to use the process, one chose to outsource, and 36 (41%) have replaced these coatings. The options for replacement are shown in Figure 16. The most popular alternative by a wide margin is trivalent-chromium-based materials with phosphating and nonchromium coatings also in use.

The final chromic acid bath for which data were obtained concerns bright dipping of brass and copper. There were 45 shops responding to this question. Of these 34 (74%) continue to use the process. Of the remaining 11, there were three choosing to outsource. Options for replacement by the rest are shown in Figure 17. The most popular alternative was buffing and polishing with five shops choosing this option.

Figure 16. Hexavalent Chromium Conversion Coating Substitutes

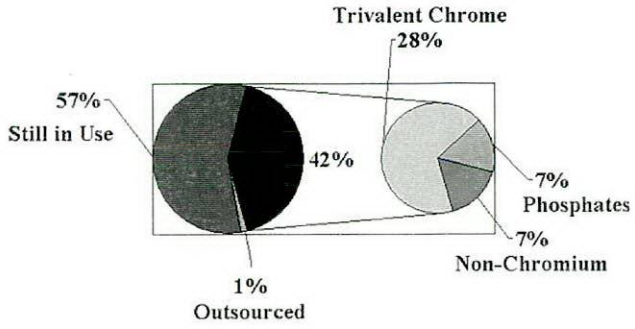
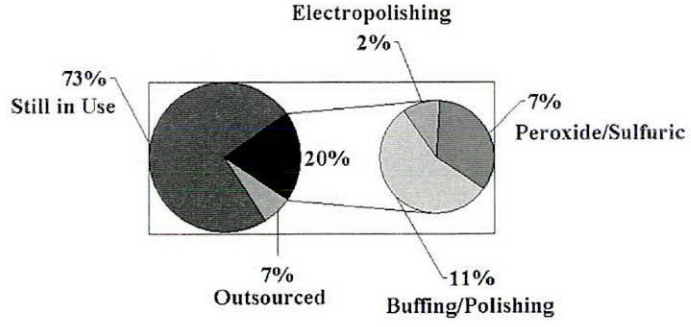


Figure 17. Substitutes for Chromium-Based Copper and Brass Bright Dips



Solutions Based on Cyanide

There were 52 shops responding on the question related to cadmium plating from a cyanide bath. Of these, only 19 (36%) continue to use this process. Three opted to outsource the process. Replacement options for the others (58%) are shown in Figure 18. Zinc plating was the most popular individual replacement, but zinc alloys collectively were the most utilized.

There were 84 responses received concerning cyanide zinc plating, of which only 26 (30%) continue to use the process. Of the others, three selected outsourcing. The favored replacements (58%) for the rest of the shops were alkaline noncyanide zinc and acid zinc with zinc alloys also garnering attention as shown in Figure 19.

Figure 18. Substitutes for Cadmium Plating

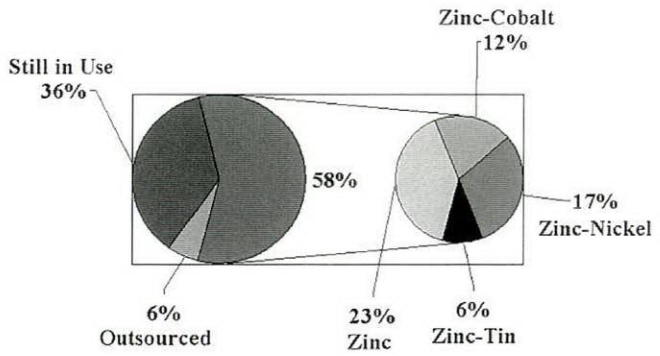
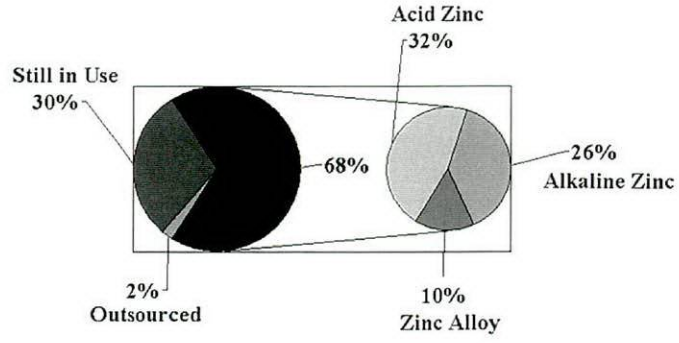


Figure 19. Substitutes for Cyanide Zinc Plating



Other Processes

Information was also gathered on replacements for decorative nickel plating and tin-lead (solder) plating. There were 58 responses for nickel of which 46 (79%) continue use of the process. Four outsource their decorative nickel plating and five reported replacements. Of these four switched to acid copper plating and one to cobalt alloy plating.

There were 18 responses concerning the use of tin-lead (solder) plating, 15 (83%) continue using the process, two have outsourced it, and one reported substitution with a pure tin plating process.

Planned Process Eliminations

The automotive job shops and suppliers were asked to list any processes they would eliminate in the next few years. Job shops reported 18 instances of processes to be eliminated. Ten of the 18 related to chromate conversion coatings. These were all due to mandates from the automotive industry to eliminate the usage of hexavalent chromium in conversion coatings. Other processes mentioned included hard chromium plating, cadmium plating, cyanide zinc plating, and vapor degreasing, due to environmental concerns, and a few miscellaneous processes due to market conditions.

Of the eight supply firms responding, five planned to stop offering processes containing hexavalent chromium, primarily in chromate conversion coatings, two planned to stop offering cyanide-based solutions, and one each to stop producing tin-lead and electroless nickel plating processes.

Planned Process Additions

There were 24 responses from automotive job shops relating to new processes to be installed. By far the most frequently mentioned were zinc alloy plating processes. These included four zinc-nickel and three zinc-iron systems with 13 mentions of zinc alloys overall (54%). Six shops indicated that they would add trivalent chromium conversion coating processes, and three planned to add black electrocoating.

The 15 automotive suppliers, who responded to this question, were unanimous in planning to add either trivalent chromium or chromium-free conversion coatings to their product offerings. One planned to introduce a low-temperature phosphating process. Three also intend to include chromium-free topcoats/sealants for conversion coatings. Two suppliers mentioned lead-free solder finishes and two others noted zinc alloys as items to be included in their product lines.

The primary reason given for the addition of these new processes for both job shops and their suppliers was environmental in nature, due to the automotive industry's ELV requirements. Both groups mentioned improved product performance as another impetus for change.

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REPORT NO. 8

NAFTA and Far East Market Trends

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REPORT NO. 8

NAFTA and Far East Market Trends

This report is published under the auspices of the Surface Finishing Industry Council (SFIC) by the American Electroplaters and Surface Finishers Society (AESF), the Metal Finishing Suppliers' Association (MFSA), and the National Association of Metal Finishers (NAMF) as a service to the metal finishing industry and contains information based on input from companies in the industry. The information published in this report was developed from actual historical information and does not include any quantitative projected information.

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EXECUTIVE SUMMARY

In recognition of the need for statistical information on the metal finishing industry and under the auspices of the Surface Finishing Industry Council (SFIC), the American Electroplaters and Surface Finishers Society (AESF), the Metal Finishing Suppliers' Association (MFSA), and the National Association of Metal Finishers (NAMF) jointly support the Surface Finishing Market Research Board (SFMRB). The board is composed of representatives of the sponsoring organizations, who meet to discuss methods to gather the data of interest, implement these methods, and then compile and report results. This report is the eighth in a series. The initial report was completed in 1994, with subsequent reports published in 1995, 1997, 1998, 1999, 2001, and 2002. This report uses chemical supplier data to report on NAFTA, Far East and worldwide trends of the plating industry over the past three years.

Some of the key findings, which are further detailed in the text, tables, and figures of the report are as follows:

- The greatest challenge facing chemical suppliers and job shop plating establishments is to deal with business moving offshore to Asia or other overseas locations.
- There are at least 15% fewer job shops and 75% fewer captive shops in the U.S. now compared to the mid 1990's.
- In 2003, NAFTA shops utilized only 66% of their finishing capacity as compared to the year 2000.
- NAFTA 2003 finishing output is down 36% from 2000. This industry now employs 107,000 fewer people, of which 88% were lost in the U.S.
- NAFTA proprietary plating chemical sales have dropped 20% in the last three years to $311 million. Domestic manufacturing employment has dropped 30% in the same time period.
- The after effects of Y2K and 9/11 have been significant factors in the closure of plating shops.
- The automotive sector still represents the largest single NAFTA market for platers and their suppliers.
- Sales of proprietary plating chemicals have risen substantially in the Far East while dropping in Europe with a greater drop in the NAFTA market area.

PURPOSE OF SFMRB

The metal finishing industry in North America has been faced with dramatic economic, technical, and regulatory challenges in recent decades. An industry under diverse pressures needs basic statistical information to know where it stands and to guide its future course. The Surface Finishing Market Research Board (SFMRB) was created in 1991 to meet this need.

SFMRB is managed by the Surface Finishing Industrial Council (SFIC), which is funded and supported by the American Electroplaters and Surface Finishers Society (AESF), the Metal Finishing Suppliers' Association (MFSA), and the National Association of Metal Finishers (NAMF). The first two SFMRB reports, completed in 1994 and 1995, focused mainly on the status of the metal finishing industry. The third, fourth, fifth, and sixth SFMRB reports, completed in 1997, 1998, 1999, and 2001 also reported on the industry status, but in addition included data on ten areas of high interest to the sponsoring members. The seventh report, completed in 2002, covered trends in the automotive industry.

METHODOLOGY

For past reports, the costs for collecting data were high and the process was quite time consuming. Mailing lists were supplied by the industry associations and publications. Survey questionnaires were prepared and sent with a cover letter and a dollar bill to further encourage participation. In several instances, over one thousand questionnaires were mailed. In order to assure confidentiality, the services of a certified public accounting firm were used to collect the surveys and to provide the SFMRB with sanitized data. This process delivered very statistically significant data and maintained a high degree of participant anonymity, but it was expensive. Final costs, including printing and other outsourced activities ran into several tens of thousands of dollars per report.

In order to conserve financial resources and reduce time, the SFMRB decided to limit the collection of data to the "supply side" (MFSA members with significant market share) for this report. In the spirit of cooperation and teamwork, 16 companies, representing 85% of all the proprietary plating chemicals in the NAFTA market, agreed to participate.

Survey questionnaires were designed and sent to the participants. To expedite the process and insure a measure of confidentiality for the participating companies, a consultant was hired. The consultant contacted each participant, gathered their data, and put the data into useable summary form for SFMRB analysis. Multiple follow-ups were required by the consultant as questions arose on how the data was recorded or reported. Costs were kept to a bare minimum, but the process remained cumbersome.

Prior to drafting this report, heads of some of the major supply companies traveled to New York at their own expense to meet with members of the SFMRB report writing team. These leaders of our industry helped to validate the collected data and to give additional insights. Use of the term "validation committee" throughout this report refers to this group. Their input was invaluable and highly appreciated.

SIGNIFICANCE OF LAST THREE YEARS

How has the plating portion of the metal finishing industry changed in the past three years? During this period we have experienced the economic downturn, the end of DOT.COM euphoria, and the effects of the terrorist actions on 9/11/2001; all of which contributed to the manufacturing recession. Also, the computer-related electronics plating business was strongly affected (negatively) in the aftermath of the "Y2K" scare. Combine these with the continued 8% per year growth of China and the rest of Southeast Asia due to the U.S. retail industry's shift to offshore sourcing. All this has accelerated the movement of a large portion of the plating business to that part of the world. This report substantiates this trend.

ELECTROPLATING SHOP INFORMATION

Numbers of Shops

The proprietary chemical plating suppliers were asked to estimate the number of plating job shops in the United States, Canada, and Mexico. Estimates varied widely, with some estimates as high as 10,000 job shops in the United States. Several of the suppliers with limited product lines, estimated the number of shops between 400 and 500. The average number of U.S. plating shops, as determined from data given by the six largest plating chemical suppliers, was 3,485. The validation committee, established to verify the industry numbers, agreed that the total number of U.S. job shops was most likely close to 3,036.

The validation committee concurred that 416 Canadian job shops and 350 Mexican job shops were valid figures (see Table I). The average job shop reported data for Mexico were considered to be valid.

Table I. NAFTA Job Shops

	Reported	Validated
United States	3,485	3,036
Canada	416	416
Mexico	324	324

As with past SFMRB studies, suppliers were not nearly as knowledgeable on the total number of captive shops in North America. Thus, the guidance of the validation committee was considered as valid. The committee believed that averages for the NAFTA region, as determined from the survey, were high and that the ratio of job shops to captive shops was close to 3:1, indicating that today there are approximately 1,000 captive plating shops in the United States. For Mexico, the data indicate that there are 222 captive shops with about 134 in Canada. The committee believes the numbers are smaller, as summarized in Table II.

Table II. NAFTA Captive Shops

	Reported	Validated
United States	2,135	1,000
Canada	134	30
Mexico	222	191

Attrition

During the past three years, the review committee believes that about 180 job and captive shops have closed for an annualized loss of $140 million in plating chemical business revenue.

The decline in the number of plating shops in North America since the year 2000 has been significant. Some were absorbed into other acquiring companies and that volume was redistributed.

There are many explanations for the attrition that took place. For example, as the electronics business moved to Asia, support companies that made non-PWB (printed wiring board) electronic components were too far away from the assembly centers and were also up against much lower cost competitors. The decline in the electronics market happened so fast that these companies did not have enough time to reinvent themselves; many of these companies simply closed. This decline was felt especially in job shops that did electroless nickel plating for printer rollers and memory discs, as well as some basic electronic components.

The environmental costs and pressures also forced some companies to close their doors rather than make the capital investments necessary to be compliant.

The estimated reduction in U.S. job and captive shops over the past 10 years, as compared to past surveys, is summarized in Table III. This reduction can be attributed to the market reduction factors mentioned earlier (Y2K and 9/11 aftermath, the end of DOT.com euphoria, and the huge retail movement toward purchasing from Asia). In addition, previous surveys counted many metal finishers who do not have electroplating operations; this current survey may not include very small shops, especially 2 - to 5-person captive operations, which are considered too small or "below the radar" to be a factor in the eyes of major chemical suppliers.

Table III. United States Job and Captive Shops

	Job Shops	Captive Shops
Mid 1990's	3,500 – 4,300	3,300 – 4,700
2003	3,036	1,000

Capacity Utilization Levels

The major proprietary chemical suppliers were asked how they would compare the current production capacity levels being used by their NAFTA metal finishing customers with the year 2000. A summary of the reported data is shown in Table IV.

Table IV. Capacity Utilization

	U.S.	Canada	Mexico
2000	100%	100%	100%
Late 2003	64.3%	72.5%	66%

Size of the NAFTA Plating Market and Employment

There are significant U.S. employment implications stemming from the capacity utilization numbers.

From past SFMRB surveys, it is believed that in the year 2000 there were approximately 3,500 U.S. job shops, with a total of 189,000 employees and sales of $16.8 billion. Each job shop averaged 54 employees, with sales of $4.8 million or $88,900 per employee.

It can also be conservatively assumed that in the year 2000 there were at least 1,200 U.S. captive operations, with a total of 72,000 employees and $10.8 billion in sales. Each captive shop averaged 60 employees, with sales of $9 million or $150,000 per employee. Therefore, there was a combined total of 261,000 employees and $27.6 billion in sales for U.S. job and captive plating shops in the year 2000.

In 2003, the 4,050 U.S. plating shops were utilizing only 64.3% of the 2000 plating capacity, the estimated plating business level was $17.7 billion in sales. Therefore, at $104,000/employee (average sales per previous surveys), the $9.9 billion decrease in plating shop sales revenue from 2000 and 2003 translates into approximately 95,200 lost U.S. plating shop jobs since 2000.

Mexican plating shop sales were down from $540 million to $356 million, and Canadian sales were down from $1.57 billion to $1 billion. Assuming a 10% currency strengthening and no shop closings, this drop in sales translates into 6,000 lost plating jobs in Mexico and in Canada.

Table V. Estimated NAFTA Plating Employment

	2000	**2003**	**Difference**
U.S	261,000	165,800	- 95,200
Canada	17,400	11,400	- 6,000
Mexico	18,000	12,000	- 6,000
Total	**296,400**	**189,200**	**-107,200**

In summary, there have been an estimated 107,000 NAFTA plating shop job losses between 2000 and 2003.

CHEMICAL SUPPLY COMPANIES

Distributor Sales

The Role of distributors continues to be a significant delivery method of proprietary chemical sales to North American electroplating shops. An estimated 27.8% of sales go through distributors. It is also estimated that the end-user product price is 5% higher on the average through distributors. In certain cases, geography dictates that the distributor is the most efficiently placed entity to satisfy the customer. Distributors sell chemistries and equipment, as well as metals. Incrementally they do quite well compared to a main line supplier who is not local.

There are a growing number of OEM or Tier 1 type electroplating customers who require a total chemical management package. The distributor usually has the best facilities and equipment locally to perform these services. Small technology companies who cannot afford to set up across North America will make arrangements with distributors to be their prime sales vehicle. Similarly, smaller foreign companies trying to break into the North America market will use the distributor method to gain immediate access to customers where the relationship with the customer is already established with the distributor.

Finally, there are some main line suppliers who have chosen distributors as the low cost sales and service method to a mature and shrinking market place.

Proprietary Chemical Sales

The 2000 through 2003 sales of the 16 survey respondents are shown in the first line of Table VI. The sales value includes all NAFTA sales combined for plating chemistry.

Reported sales figures for 14 of the 16 respondents did not take into account the markups on sales through distributors. Accordingly, the second line in Table VI accounts for the distributor effect of an additional 5%.

It was the consensus of the validation committee that the contributors to this survey constituted 85% of plating chemical sales to NAFTA. Thus, the current annual market could be assumed to be $311 million as shown in the third line, with 15% added.

Note the sales decreases for each year, which totals slightly more than 20% over this three year period. This is illustrative of the drop-off after the year 2000 and subsequent lower sales years as business was shifted offshore.

Table VI. Three Year Total NAFTA Proprietary Chemical Sales

	2000	2001	2002	2003
Raw sales (16)	$328	$291	$279	$263
W/dist. Markup	$330	$293	$281	$265
15% added	$389	$345	$331	$311
%/yr change		-11.3%	-4.1%	-5.7%
Total 3-year %	**-20.1%**			

Supplier Employee Base

The figures in Table VII are based on complete data from all 16 companies. Companies were asked to classify all employees into three groups: sales (field sales including technical service), manufacturing, and administrative. The largest percentage of job loss was in manufacturing, with a reduction of 30.4%.

It is estimated that the 16 major suppliers surveyed constitute 85% of all the proprietary plating chemicals in the NAFTA market, therefore the entire sector currently employs approximately 1,474 people. This is down 23% from the year 2000 figure of 1,816 employees.

Table VII. NAFTA Employment of 16 Primary Chemical Suppliers*			
	2000	**2003**	**% Change**
Sales Personnel	446	399	-10.5%
Manufacturing	701	488	-30.4
Administrative	397	355	-11.8%
Total Employees	**1,544**	**1,253**	**-23.2%**
** Includes part time employees*			

Plating Processes Sold

There are nine plating processes most frequently offered by the major chemical manufacturers. The following seven were included in this survey:

- Copper/Nickel/Chrome (otherwise known as "decorative")
- Electroless Nickel
- Tin and Tin Alloys
- Zinc and Zinc Alloys/Chromates/Topcoats
- Precious Metals – Gold/Silver/Palladium (additives without metals)
- Plating on Plastics (pre-plate only)
- Surface Conditioning (Strippers, Cleaners & Acid Salts)

Sales of chemicals for hard (industrial) chrome and printed circuit boards (PCBs) were not included in the survey.

The estimated total of NAFTA proprietary plating chemical sales in 2003 is shown in Table VIII. The amount for each process is given, along with the overall total.

Table VIII. Proprietary Plating Chemical Process Sales for 2003	
Copper/Nickel/Chrome (otherwise known as "decorative")	$65 mil
Electroless Nickel	$50 mil
Tin and Tin Alloys	$30 mil
Zinc and Zinc Alloys/Chromates/Topcoats	$60 mil
Precious Metals – Gold/Silver/Palladium (additives without metals)	$25 mil
Plating on Plastics (pre-plate only)	$12 mil
Surface Conditioning (Strippers, Cleaners & Acid Salts)	$69 mil
Total	**$311 mil**

Markets Served

The $311 million in annual NAFTA plating chemistry sales is allocated to the market segments shown in Table IX. The automotive and electronics markets continue to be the dominant segments, which confirms earlier surveys.

Table IX NAFTA Plating Chemical Market Segments		
Segment	**Sales**	**Market Share**
Appliances	$18.1 mil	5.8%
Automotive OEM (including light trucks & suvs)	$87.6 mil	28.1%
Automotive Aftermarket	$27.8 mil	8.9%
Trucks	$8.2 mil	2.6%
Civilian Aircraft	$5.1 mil	1.7%
Computer/Communications/Electronics	$57.8 mil	18.6%
Defense/Military/Government	$10.4 mil	3.3%
Fasteners (part of auto)	$18.9 mil	6.1%
Furniture/Fixtures/Lighting	$10.9 mil	3.5%
Hardware/Tools	$16.0 mil	5.2%
Machinery/Industrial Equipment	$25.0 mil	8.0%
Plumbing Fixtures	$7.9 mil	2.5%
Sporting Goods	$3.9 mil	1.3%
Others	$13.6 mil	4.4%
Total	**$311.2 mil**	**100%**

In the Table X, the NAFTA industry segment percentages served by suppliers in 2003 are compared to the surveys conducted by SFMRB in the early 1990's and those conducted in the 1996-1998 time period for job shops and captives. Past survey responses were weighted to account for the size of the finishers. The current survey used actual sales by each supplier to each market segment. Automotive and computer/electronics continue to be the two largest industry segments served by all finishers, with the automotive segment continuing to be nearly half of the NAFTA electroplating business. Automotive OEM and aftermarket, trucks, and fasteners have been lumped as one into the automotive category. It is important to note that the scope of this report did not include wet process plating of PCBs. However, if included, then the computer/electronics market segment would actually account for approximately 35% (not 18.6%) of all NAFTA plating.

Table X Comparison of Markets Served (%)

Industry Segment	1992-1993	1996-1998	2003
Appliances	---	6.0	5.8
Automotive	44.2	31.7	45.7
Civilian Aircraft	5.2	6.8	1.6
Computer/Electronics	11.0	15.1	18.6
Defense/Military	4.7	8.6	3.3
Furniture/Fixtures/Lighting	---	4.0	3.5
Hardware/Tools	---	4.0	5.1
Machinery/Industrial Equip.	3.9	9.6	8.0
Plumbing/Fixtures	2.2	3.6	2.5
Sporting Goods	3.0	0.2	1.3
Consumer Durables	9.3	---	---
Other	16.5	10.4	4.4
	100%	**100%**	**100%**

SOUTHEAST ASIA MARKET DATA

Total Sales Volume

Respondents were requested to report their metal finishing sales for the Southeast Asia market area. Seven firms reported a total of $226 million in the year 2000. Comparable figures for 2003, as reported in mid-year, were $283 million. This represents a 25.2% increase or about 8% per year, which happens to match the reported increase in GDP (gross domestic product) for China over the same period. The validation committee, which met in early 2004, believes that the chemical market sales will grow to $400 million annually by the end of 2004 as the world economy improves. This would indicate an increase of 21% per annum.

Future Trends

Six respondents expected growth to continue at the 8% per year level. This may need revision as noted by the review committee's expectation of 21% per anum increase.

Supplier Employment in the Far East

Five firms reported on the number of their employees in the Far East. The average in 2000 was 128 employees. In 2003, the number had grown to 250. This represents an increase of 25% per year. It was noted that employment levels might outpace sales since the cost of hiring and maintaining employment was substantially lower in Far East market areas.

SALES TRENDS WORLDWIDE

The difference in the total volume of proprietary plating chemical products sold in various market areas in the years 2000 and 2003 was reported by several supply firms. The data were unfortunately reported in different formats, so that only percentage changes could be compared.

Ten companies reported data for the NAFTA market area. The average percentage loss of the ten firms was 12%. When adjusted for company revenue, the loss was 18% over the 3-year period.

Six firms reported on sales volumes in Europe. The average loss was 9%, with the sales adjusted figure a loss of 8%.

Five firms reported a net gain in product volume sales in the Far East of 41%. The sales adjusted net again was 126%

The conclusion is that North America is suffering greater losses in this business area than Europe, but that Southeast Asia is experiencing huge growth.

CHALLENGES FACING SUPPLIERS

Respondents were queried regarding the challenges to their finishing businesses in the coming years. Each metal finishing supplier firm was asked to list the three top challenges to be faced over the next three years. The results are summarized in Table XI. The column at the left lists the challenges mentioned. The responses are listed for 16 firms showing the number of responses for first, second, and third choices along with a total response and a weighted response, giving 3 points for a first choice, 2 for second, and 1 for third.

With few exceptions, nearly every firm mentioned movement of business offshore to Asia or other overseas locations as the number one or number two challenge. Next in importance was pressure on pricing. These challenges are, of course, directly related. Business moves offshore primarily to reduce costs. Considerations related to the quality of products or ease of distribution are secondary to pricing implications. Respondents also mentioned environmental factors and technological changes as important challenges.

Other items included the high cost of benefits for employees and reduced market size, which are also related to business moving offshore.

The suppliers were asked what plans they had formulated to address these challenges. Regarding the loss of customers due to relocation of production operations overseas, approximately one-half of the respondents indicated that they would establish local operations or seek distribution partners in the areas to which their customers moved. One large company demurred and indicated that it would not set up an operation in Asia. About one-quarter of the respondents would lobby customers/OEMs or political entities to keep customers in the United States. One firm stated that the aim would be to reduce the end-user's costs.

The response to pricing pressures was aggressive. Nearly half the firms plan to increase research and development to produce innovative products. One-quarter will improve cost controls or streamline business systems. One company suggested that it would push its service capabilities. There were three comments relating to environmental factors: two firms plan to develop new products to meet this challenge, and the third will rely on the lobbying efforts of the NAMF/MFSA in Washington, D.C.

TABLE XI. Top Three Challenges Facing Finishing Industry Suppliers

Challenge	First	Second	Third	Total	Weighted 3, 2, 1
Customers Moving to Asia	7	4	0	11	29
Customers Moving to Other Overseas Areas	3	3	0	6	15
Pricing Pressure	2	7	5	14	25
Environmental Concerns	2	1	2	5	10
Technological Changes	0	0	6	6	6
Others	2	1	3	6	11

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Surface Finishing Industry Council



American Electroplaters and Surface Finishers Society, Inc.



Metal Finishing Suppliers' Association



National Association of Metal Finishers



Surface Finishing Industry Council



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Metal Finishing Suppliers' Association



National Association of Metal Finishers



METAL FINISHING INDUSTRY MARKET SURVEY

REPORT No. 9

An Update on Job Shop Operations

MOVING FORWARD TOGETHER

SFMRB

Surface Finishing Market Research Board

SFMRB METAL FINISHING INDUSTRY MARKET SURVEY

REPORT No. 9

An Update on Job Shop Operations

This report is published under the auspices of the Surface Finishing Industry Council (SFIC) by the American Electroplaters and Surface Finishers Society (AESF), the Metal Finishing Suppliers' Association (MFSA) and the National Association of Metal Finishers (NAMF) as a service to the metal finishing industry and contains information based on input from companies in the industry. The information published in this report was developed from actual historical information, and does not include any quantitative projected information.

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EXECUTIVE SUMMARY

In recognition of the need for statistical information on the metal finishing industry and under the auspices of the Surface Finishing Industry Council (SFIC), the American Electroplaters and Surface Finishers Society (AESF), the Metal Finishing Suppliers' Association (MFSA) and the National Association for Metal Finishers (NAMF) jointly support the Surface Finishing Market Research Board (SFMRB). The board is composed of representatives of the sponsoring organizations, who meet to discuss methods to gather the data of interest, implement these methods, and then compile and report the results.

This report is the ninth in the series. The initial report was completed in March of 1994, with subsequent reports on a near annual basis thereafter. This report updates the information from previous reports and incorporates additional details requested by individual members.

Some of the key findings, which are reported in detail in the text, tables and figures of the report, include the following:

- The majority of finishers reported year-to-year sales revenue increases in 2004 compared to 2003. The outlook for 2005 is more optimistic with long-term prospects even brighter.
- The average job shop serves more than a half dozen industrial market segments.
- The medical, defense/military/government and automotive/truck aftermarkets are considered the best market segments for growth.
- Decorative nickel is the most popular electroplating process, with decorative trivalent chromium, zinc-nickel alloy and electroless nickel the fastest growing.
- More than 90% of job shops are non-union.
- The average job shop has over 200 customers with many serving international clients.
- Job shop finishers plan a 20% increase in capital expenditures for 2005 compared to 2004.
- Many job shops are promoting their services on their own web sites.
- Job shop operating costs are higher than in previous surveys.
- ISO 9000 is the most common quality control program among finishers with nearly 60% currently certified.
- Hexavalent chromium is the primary process planned for elimination.
- The greatest challenge facing metal finishers is business moving offshore.

SFMRB is offering customized regional or specific process reports of this data for a modest fee. A regional report (e.g., California) or a focused report (e.g., electroless nickel) can be prepared.

PURPOSE OF SFMRB

The metal finishing industry in North America has been faced with dramatic economic, technical, and regulatory challenges in recent decades. An industry under diverse pressures needs basic statistical information to know where it stands and to guide its future course. The Surface Finishing Market Research Board (SFMRB) was created in 1991 to meet this need.

SFMRB is sponsored by the Surface Finishing Industry Council (SFIC), which in turn is jointly funded and supported by the American Electroplaters and Surface Finishers Society (AESF), the Metal Finishing Suppliers' Association (MFSA), and the National Association of Metal Finishers (NAMF). The early SFMRB reports, completed in 1994 and 1995, focused mainly on the status of the electroplating portion of the metal finishing industry. Since then subsequent reports reported on the industry status, but also included data on special areas of high interest to the sponsoring members.

The information in these reports helps both metal finishers and their suppliers make better decisions regarding areas for business development and provides the industry with more detailed information regarding employment and commercial activity for use in presentation to governmental and regulatory bodies.

This report was prepared to update information in the previous studies and include some additional details.

PREFERENCE SURVEY

In June of 2004 a preference survey was conducted to determine the areas of interest of members of NAMF, one of the sponsoring organizations, regarding topics to be investigated by the SFMRB. Most had been addressed in the past and were considered of continued interest. They included:

- Economic outlook for finishers
- Cost of compliance with environmental and safety regulations
- Finishing processes in use
- Industries served by finishers.
- Use of quality assurance tools.

In addition, more extensive data on the cost of operating a finishing facility would be gathered and the usage of computers and the internet in finishing shops would be addressed. In addition a database would be set to permit more detailed information to be derived.

METHODOLOGY

A mailing list of all NAMF members was supplied by their director. An extensive questionnaire was designed to be anonymous when returned and easy to fill out. The questionnaire was sent to each NAMF member with a strong covering letter, a discount certificate for the final report and a dollar bill to further encourage participation.

SURVEY RESPONSES

The questionnaire was mailed in January 2005 to the 579 NAMF job shop members. It posed questions related to sales, employment, cost of operations, markets served, processes and equipment employed and the economic outlook for the next few years.

The excellent response rate for the survey, along with comparisons to past surveys, is presented in Table 1.

Table 1 Survey Response Compared to Previous Surveys

	1997	2000	This Report
List Size	7,938	13,425	579
Number Mailed	2,000	2,000	579
Usable Returns	511	428	161
Response Rate	**25.5%**	**16.4%**	**27.8%**

GENERAL INFORMATION

Plant Locations

Table 2 shows the nine areas used to group the responses geographically, broken down by percentage of plant sites in each of the eight U.S. regional areas shown in Figure 1 and Canada with comparisons to the previous two surveys. Past surveys have indicated that 40% of metal finishers are located in the East and West Central areas. This is not the case as reported by respondents for this report. The West may have been under reported in past surveys, but it is not surprising that this survey had a higher response rate from the state of California since the NAMF affiliates in that state represent a large percentage of the total NAMF membership, which served as the mailing list for this report. (Over 200 from the latest published edition of the NAMF Membership Directory.)

Table 2 Survey Response by Region Compared to Previous Years (See Figure 1)

Region	1997	2000	This Report
New England	10.4%	9.5%	6.2%
Mid-Atlantic	12.7%	13.8%	14.2%
Southeast	6.4%	8.3%	4.9%
East Central	20.5%	19.0%	18.0%
West Central	19.8%	20.9%	13.6%
Southwest	4.7%	7.9%	4.3%
West	21.4%	17.4%	36.0%
Northwest	4.0%	3.2%	3.5%
Canada	–	–	1.2%

Figure 1 Geographical Regions for Data in Table 1



Facility Age

Each finisher was asked how long his facility has been in operation, a new detail of interest. The 160 responses received are summarized in Table 3. Note that a large majority (79.3%) of the respondents indicates that their facilities have been in operation for over 25 years. (The next time this question is addressed there will be additional categories for the over 25-year ranges in order to develop a statistically significant average facility age.) The large number over 25 years may be an indication of consolidation wherein the older and larger companies have purchased or taken the business from others who may have closed. It is also characteristic of a business sector that is not growing and is thus not attracting many new companies.

Table 3 Facility Age

Range in Years	Percentage Response
<2	None
2-5	0.6%
6-10	1.3%
11-15	6.3%
16-25	12.5%
>25	79.3%

Employment

Employment levels for the job shop responders are summarized in Table 4. There were a total of 161 responses to this question. The average number of employees per shop is 52.2 and the median is 27.5. These include all employees at the location including production, sales, laboratory, management and shipping, both full-time and part-time The data indicate a median of 27.5 and an average of 52.2 job shop employees per facility. In past surveys, job shops were indicated to have medians of 17 to 23 and averages of 40 to 50.

The median here and in subsequent tables is taken as the number of employees for the shop in the middle of the group, for example, the third shop in a ranked list of five; while the average is the sum of all employees for all shops divided by the number of shops. Since values were tabulated as ranges of numbers the averages in this case and in subsequent tables were calculated as follows.

The midpoint of each range was multiplied by the percentage of data in that range. The midpoint of the highest range, designated as more than a certain figure, was selected as being the same amount above the midpoint of the prior range. The sum of each calculation yields the average.

For example, with the following set of values:

<3 - 20%
3-5 - 30%
5-8 - 40%
>8 - 10%

The average =
1.5 x 0.2 + 4 x 0.3 + 6.5 x 0.4 + 9.5 x 0.1 = 5.05

Table 4 Number of Job Shop Employees

Number	1997	2000	2004
1-2	Included in 3-5	4.7%	None
3-5	13.6%	9.4%	2.4%
6-10	14.7%	14.4%	9.9%
11-20	17.8%	15.1%	19.3%
21-30	12.7%	10.8%	20.0%
31-50	16.7%	14.7%	16.8%
51-75	9.4%	9.4%	9.3%
76-100	6.7%	8.6%	6.8%
101-200	7.5%	8.3%	12.4%
>200	1.1%	1.4%	2.4%

Shipping Practices

Table 5 indicates how many trucks are owned or leased by finishers. There is no question that many shops have shifted the responsibility for the cost of pick-up and delivery to the customer. The average finisher operates 2.2 of his own trucks.

The average one-way distance driven by the trucks operated by finishers for pick-up and/or delivery was 64 miles with a median of 47 miles. In other words, the finishers are primarily providing trucking services for local customers. Table 6 makes this clear, with 50% of the one-way truck distance shown to be less than 50 miles.

Table 7 gives the breakdown of the percentage of finisher-borne costs for 143 respondents. The response is fairly evenly distributed over the range of levels, with an average of 32% of freight paid by the finisher. The total expense for shipping is included below in the section on job shop operating costs.

Table 5 Number of Trucks Owned/Leased by Finishers

Number	Percentage Owning
None	16%
1-3	70.5%
4-6	11.5%
7-10	2%
>10	None

Table 6 Average One-Way Distance Traveled by Finishers' Trucks

Distance, miles	Percentage
<25	20.9%
25-49	33.6%
50-74	19.4%
75-99	8.6%
100-149	10.5%
150-250	4.4%
>250	2.3%

Table 7 Percentage of Total Freight Paid by Finishers

Percentage Paid	Number Paying
None	14.6%
1-9.9%	23.7%
10-24.9%	18.8%
25-49.9%	14.6%
50-74.9%	17.4%
75-100%	10.9%

ECONOMIC OUTLOOK

Metal finishers were requested to provide information on recent annual sales revenue and to estimate the outlook for near and long-term sales. It was found, in general, that the outlook for the future is fairly optimistic.

Sales Revenue

The 2004 sales revenue for job shops is summarized on Table 8. In comparing the results of the 158 respondents with previous surveys, it is obvious that the distribution is shifted upward toward the larger sized facilities and away from the smaller shops. The data are presented as a percentage of respondents for each category range. The average sales volume per shop for 2004 was $4.7 million (compared to 4.8 million in 2000 and $3 to 3.2 million in 1997). The median was $2.65 million (compared to $ 2.2 million in 2000 and $1.5 to 1.7 million in 1997).

Table 8 Metal Finishing Job Shop Sales Revenue

$, Millions	1997	2000	2004
<0.25	8.7%	10.0%	1.8%
0.25-0.5	11.0%	6.2%	4.4%
0.5-1	15.6%	13.5%	9.4%
1-2	22.1%	18.5%	19.6%
2-3	13.3%	12.4%	21.5%
3-5	12.9%	11.6%	16.4%
5-7	5.3%	6.6%	8.2%
7-10	5.3%	6.2%	8.2%
10-15	3.4%	6.9%	6.9%
15-20	1.2%	2.7%	0.6%
>20	1.2%	5.4%	1.2%

The primary reason for higher levels is that the survey for this report was limited to NAMF members. It was demonstrated from earlier data that NAMF job shops have nearly twice the average sales revenue of non-member shops, which tend to be smaller. The data from Tables 4 and 5 indicate a job shop revenue per employee of $90,000. This has ranged from $75,000 to $89,000 in past reports.

Business Trends

Figure 2 indicates how job shop sales fared in 2004 compared to 2003. There were 160 responses to this question. A total of 61.3% of finishers reported sales were up. The distribution of sales increases is shown in Figure 3 with an average increase of 11.4%. Similarly, 25.6% of respondents experienced a drop in sales. This distribution is given in Figure 4 and resulted in an average decrease of 9.2%. The balance of 13.1% reported no expected change. The net result is an average 7.4% increase for 2004 compared to 2003.

Figure 2 Sales Revenues for 2004 Compared to 2003

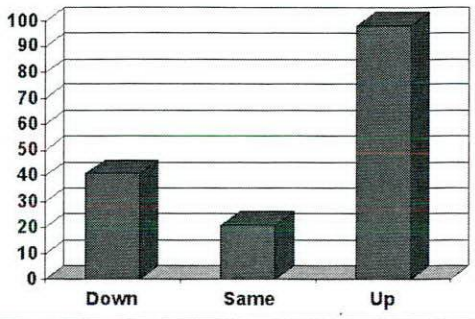


Figure 3 Distribution of 2004 Sales Revenue Increases

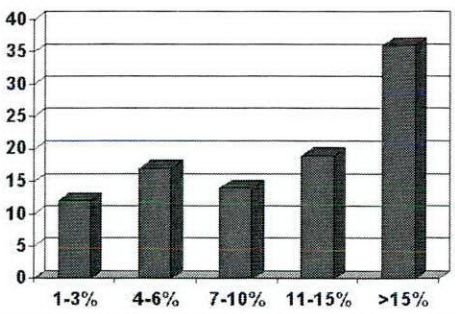
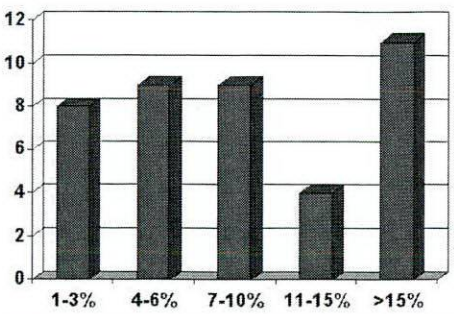


Figure 4 Distribution of 2004 Sales Revenue Decreases



Business Forecasts

Nearly 70% of the 159 responding finishers forecast an increase in business for 2005 as shown in Figure 5. Figures 6 and 7, respectively, provide the distributions for the increases and decreases. There were equal numbers of finishers (15.1%) expecting near-term flat or down trends. Both the increased and decreased distributions averaged 8.2%. The net result is an overall forecast for a 7.1% improvement for 2005.

Figure 5 Anticipated Sales Revenue for 2005 over 2004

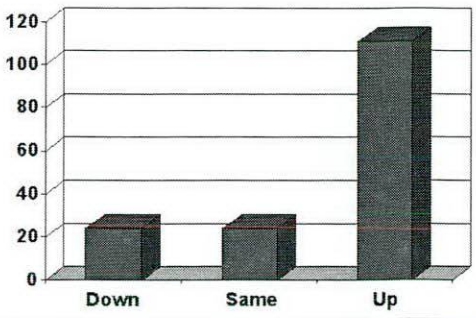


Figure 6 Distribution of 2005 Anticipated Sales Increases

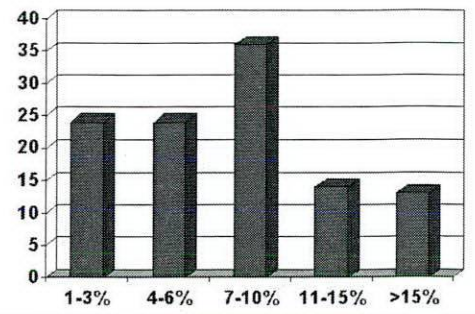
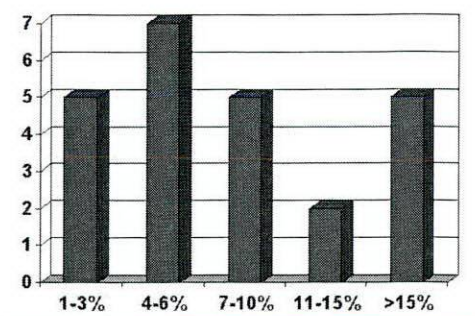


Figure 7 Distribution of 2005 Anticipated Sales Decreases



The responders are also optimistic (see Figure 8) for the long term (5 years) with 79.1% expecting an average 5.7% increase annually as shown in Figure 9. There were 9.8% who expected an annual decrease (See Figure 10 for distribution) averaging 4.7%. The result amounts to a long-term forecast of a sales increase of 6.2% per year.

Figure 8 Anticipated Long-Term Sales Revenue

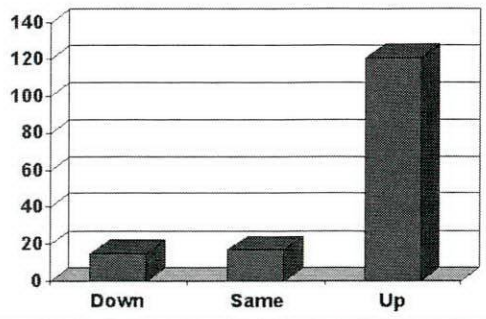


Figure 9 Distribution of Annual Increases in Anticipated Long-Term Sales

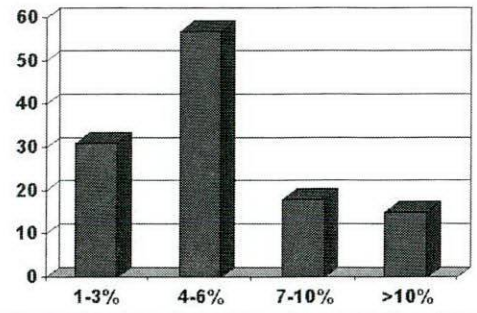
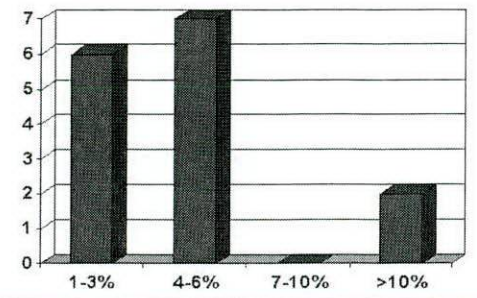


Figure 10 Distribution of Annual Decreases in Anticipated Long-Term Sales



JOB SHOP CAPITAL COSTS

Recent Expenditures

The amount spent for capital equipment in 2004 is shown in Table 9. There has not been a marked change since 1997. The 159 respondents averaged $138,000 in capital expenditure with a median of $42,700. Capital expenditures related to regulatory compliance are presented below in a separate section.

Table 9 Capital Equipment Expenditures for Job Shops

$, Thousands	1998	2004
<10	21.1%	22.0%
10-24.9	18.3%	16.4%
25-49.9	16.7%	16.4%
50-99.9	16.1%	17.0%
100-249.9	17.4%	13.8%
250-499.9	5.0%	8.8%
500-1,000	3.4%	2.5%
>1,000	2.0%	3.1%

Planned Expenditures

Capital equipment expenditures planned for 2005 are listed in Table 10. The 160 respondents indicate an increase (19.6%) in expenditures with an average of $165,000 vs. $138,000 for 2004. The median is also slightly higher at $46,000 vs. $42,700. This represents a degree of job shop optimism for the future of the finishing business.

Table 10 Anticipated Capital Equipment Expenditures for 2005

$, Thousands	Estimated for 2005
<10%	15.6%
10-24.9%	21.3%
25-49.9%	16.3%
50-99.9%	11.2%
100-249.9%	16.3%
250-499.9%	11.2%
500-1,000	5.6%
>1,000	2.5%

JOB SHOP OPERATING COSTS

In this section, general operating expenditures are reported for job shop finishers. The data indicate that there has been a definite trend toward higher costs and lower profits.

Payroll

Table 11 summarizes the payroll expense distribution in job shops as a percentage of sales revenue and compares them to previous surveys. The median response percentage of sales revenue for payroll was 34%, higher than the 27% reported for 1997. Earlier surveys (1994, 1995) reported median labor costs for job shops in the 28 to 32% range. The average payroll percentage of revenue in this survey was 33% compared to 28% in 1997.

Table 11 Job Shop Payroll Costs

% of Sales	1997	2004
<15	6.0%	0.6%
15-19.9	13.7%	6.3%
20-24.9	17.8%	6.3%
25-29.9	18.9%	23.4%
30-34.9	18.0%	16.5%
35-40	15.3%	18.4%
>40	10.4%	28.5%

Table 12 Job Shop Selling and Administrative Expenses

% of Sales	1997	2004
<5	Included with 5-9.9	16.3%
5-9.9	44%	38.6%
10-14.9	31.8%	17.6%
15-19.9	13.3%	12.4%
20-24.9	4.1%	8.5%
25-30	4.1%	5.2%
>30	2.7%	1.3%

Selling and Administrative

Table 12 summarizes the selling and administrative (SG&A) expense distribution as a percentage of sales revenue and provides a comparison to a past survey from seven years ago. The average percentage for SG&A in 2004 was 11.5% compared to 11.0% in 1997 and the median response was 9.3%. This appears to be a relatively constant expense for job shops.

Finishing Materials

Material costs as a percentage of sales revenue are reported in Table 13. In the 1997 survey, the average spending on materials was 13.8% and the median was 12.9%. The average spending data reported for 2004 is slightly lower than in 1997 where material costs were in the 14 to 19% range. Medians were not reported in the past survey.

Table 13 Cost of Finishing Materials

% of Sales	1997	2004
<5	7.5%	7.1%
5-9.9	30.6%	23.7%
10-14.9	27.2%	32.7%
15-19.9	18.5%	17.9%
20-25	11.6%	7.1%
>25	4.6%	1.3%

Buildings

Table 14 summarizes the building expense (rent/mortgage) in shops as a percentage of sales revenue. The average percentage for rent and/or mortgage by job shops was reported as 3.5%, slightly lower than the 4% reported in 1997. The median responder's building expense, not reported in the past, was 3.1%.

Table 14 Building Costs (Rent/Mortgage) for Job Shops

% of Sales	1997	2004
<1	Included below	30.1%
1-1.9	33.4%	9.0%
2-3.9	24.4%	19.2%
4-5.9	19.9%	25.0%
6-7.9	9.3%	9.0%
8-10	8.2%	4.5%
>10	4.8%	3.2%

Maintenance

Maintenance costs as a percentage of sales revenue are summarized in Table 15. The average value was 4.5% compared to 4.2% in the last survey. The median was 4.1%.

Table 15 Job Shop Maintenance Costs

% of Sales	1997	2004
<2	16.2%	12.7%
2-3.9	34.9%	35.4%
4-5.9	31.6%	27.2%
6-7.9	8.6%	13.9%
8-10	7.3%	9.5%
>10	1.4%	6.3%

Utilities

The cost of utility services as a percentage of sales revenue is reported in Table 16 and compared to previous surveys. The average is 7.3% compared to 6 to 6.2%, which represents a substantial increase in this category. Utility cost increases are the likely effect of the recent higher costs of energy. The median response was 6.7%.

Table 16 Job Shop Utility Costs

% of Sales	1997	2004
<3	11.8%	6.3%
3-4.9	25.0%	19.6%
5-6.9	28.5%	27.2%
7-9.9	21.0%	24.1%
10-12	9.4%	13.3%
>12	4.3%	9.5%

Shipping

Table 17 shows that nearly half of the job shops have shipping costs below 1% of sales. The average cost was 1.4% of revenue as compared to 2.1% reported in the 1997 survey. This may indicate that the increased cost of fuel has led to finishers charging, or increasing the charges, for pick-up and delivery of parts. Further information on shipping practices is provided in a separate section.

Table 17 Job Shop Shipping Costs

% of Sales	Response
<1	44.8%
1-1.9	19.2%
2-2.9	12.2%
3-3.9	7.1%
4-5	4.5%
>5	3.2%

Other Expenses

Tables 18 through 21 display the job shop costs for health care, workmen's compensation, other insurance payments and education/training. Each category is displayed versus the percentage of annual sales revenue. The comparative averages and medians are shown in Table 22.

Table 18 Job Shop Health Care Costs

% of Sales	1997	2004
<1	13.9%	8.3%
1-1.9	23.1%	10.9%
2-2.9	25.8%	19.9%
3-3.9	19.7%	19.2%
4-5	10.6%	21.2%
>5	6.9%	20.5%

Table 19 Job Shop Workmen's Compensation Costs

% of Sales	1997	2004
<1	16.9%	14.8%
1-1.9	39.9%	29.7%
2-2.9	22.2%	26.9%
3-3.9	10.5%	11.0%
4-5	7.2%	1.9%
>5	3.3%	14.2%

Table 20 Other Job Shop Insurance Costs

% of Sales	1997	2004
<1	25.6%	17.3%
1-1.9	39.7%	32.1%
2-2.9	15.4%	16.7%
3-3.9	8.0%	15.4%
4-5	6.3%	10.3%
>5	5.0%	8.3%

Table 21 Job Shop Education and Training Costs

% of Sales	1997	2004
<1	62.8%	67.3%
1-1.9	25.3%	25.0%
2-2.9	8.8%	7.1%
3-3.9	1.9%	0.6%
4-5	1.1%	None
>5	None	None

Table 22 Average and Median Values for Various Costs

	1997 Average	2004 Average	2004 Median
Health Care	2.6%	3.5%	3.5%
Workman's Compensation	2.1%	2.6%	2.2%
Other Insurance	1.9%	2.4%	2.0%
Education/Training	1.0%	0.9%	0.7%

It should come as no surprise that the comparative data over a 7-year period indicate an overall increase in insurance costs of nearly 29% based on sales revenue percentage figures for health care, workman's compensation and other insurance. Training costs have remained about the same.

Average Job Shop

The average values for all the above expense categories are combined in Table 23. They total 90.4% for the average job shop with annual sales of $4.7 million. The balance of 9.6% would represent profit before taxes, interest and depreciation assuming their was no double-counting between categories (e.g., payroll and SGA). These data indicate an increase in expenses and thus a reduction in profit over the past 7 years. This trend of creeping cost increases in many areas comes as no surprise to anyone who has been in the metal finishing business over the past 10 to 15 years. Table 24 lists the items with the greatest percentage increases, led by regulatory compliance and employee benefit issues.

Table 23 Average Job Shop Operating Costs

Expenditure	% of Sales in 1997	$ of Sales in 2004
Payroll	28.0%	33.0%
General/Administrative	11.4%	11.5%
Finishing Materials	17.0%	13.8%
Utilities	6.3%	7.3%
Environmental Materials	3.3%	3.9%
OSHA Compliance	1.1%	2.2%
Maintenance	4.2%	4.5%
Buildings	4.0%	3.5%
Health Care	2.6%	3.5%
Workmen's Compensation	2.1%	2.6%
Other Insurance	1.9%	2.4%
Education and Training	1.0%	0.9%
Shipping	2.1%	1.4%
Total	**85.0%**	**90.5%**

Table 24 Greatest Increases in Average Expenditures

Expenditure	Percentage Increase
OSHA Compliance	100%
Health Care	42.0%
Other Insurance	26.3%
Workmen's Compensation	23.8%
Payroll	17.9%
Utilities	15.9%
Environmental Materials	15.2%

The average expenses for small, medium and large shops, with average annual sales volumes of $1.1 million, $3.1 million and $11.7 million, respectively, are shown in Table 25. Each group represents approximately one-third of the total responses.

Table 25 Average Operating Costs for Small, Medium, and Large Job Shops as a Percentage of Sales Revenue

Expenditure	<$2 Million	$2-5 Million	>$5 Million
Payroll	32.5%	33.4%	34.4%
General/ Administrative	11.1%	11.9%	11.3%
Finishing Materials	13.2%	13.7%	14.8%
Utilities	7.4%	7.8%	6.5%
Environmental Materials	3.7%	4.3%	3.5%
OSHA Compliance	2.1%	2.2%	2.2%
Maintenance	4.3%	4.2%	5.1%
Buildings	4.1%	3.5%	2.7%
Health Care	3.3%	3.5%	3.6%
Workmen's Compensation	3.1%	2.7%	2.0%
Other Insurance	2.7%	2.5%	2.1%
Education and Training	0.9%	0.8%	1.1%
Shipping	1.4%	1.5%	1.4%
Total	**89.8%**	**92.0%**	**90.7%**
Average Sales for the Group	**$1.1 Million**	**$3.1 Million**	**$11.7 Million**

Large shops tend to spend more for payroll, materials, maintenance, health care and training, while small shops have a proportionately higher outlays for buildings, workman's compensation and other insurance. It is interesting that the middle third group is the least profitable, which may explain observations made by SFMRB for the past ten years. Metal finishers seem to be grouped into small entrepreneurial operations or large, efficient automated operations, with a lower than normal representation of mid-sized finishers. Thus the "bell-shaped" statistical average usually seen has been replaced by a flat distribution.

JOB SHOP COMPLIANCE COSTS

In the following sections, data on personnel and the costs (operating and capital) related to job shop compliance with regulations are summarized. As expected, these costs have risen significantly over the past seven years.

Capital Expenditures

Capital expenditures for equipment in 2004 to comply with the regulations are shown in Table 26. Similar to earlier surveys roughly three-fourths of the 159 respondents (77.3%) spent less than $30,000. The average spent was $25,000 and the median $9,300. In the previous period the average was $30,000. Taking into account inflation, this represents a considerably lower current level of compliance capital expenditures than seven years ago. It likely indicates that much of this type of spending has already been completed.

Capital expenditure plans for compliance in 2005 are also shown in Table 26. An increase is shown compared to 2004. The average for the 159 respondents was $29,000 and the median $14,000.

Table 26 Capital Equipment Expenditures for Regulatory Compliance

$	2004	Anticipated in 2005
<5,000	31.4%	25.8%
5,000-9,999.9	22.0%	18.9%
10,000-29,999	23.9%	25.8%
30,000-49,999	8.8%	13.7%
50,000-99,999	9.4%	10.7%
100,000-199,999	3.2%	3.7%
>200,000	1.3%	1.3%

Personnel Costs

The results from the 154 respondents that answered this question are shown in Table 27. The number of regulatory compliance related employees is given along with a comparison to the last survey. The average finisher now has 2.7 employees devoted to compliance related activities compared to 2.5 in the

past survey. This means that an average of 5.2% of a job shop's employees are regulatory-related employees compared to 6.2% seven years ago. *(This percentage is based on the above 2.5 regulatory employees divided by the total average of 52.2 employees per job shop, calculated earlier in this report from Table 4.)*

Table 27 Number of Employees Engaged in Compliance-Related Activities

Number	1997	2004
0-1	42.4%	36.3%
2-3	38.8%	42.2%
4-6	13.9%	16.8%
7-10	3.1%	1.3%
>10	1.8%	3.2%

The cost of these regulatory related employees (operators, inspectors, etc.) is shown in Table 28. Cost categories are displayed as a percentage of sales revenue. The percentage of the 155 respondents in each category is listed. The average is 2.3% of revenue as compared with a 2.1% rate seven years ago. This means that an average job shop now expends 6.8% of its total payroll cost on regulatory related employees versus 7.5% seven years ago. *(This average was calculated by dividing the 2.3% by the average job shop payroll expenditure of 34% reported earlier in this report.)* Regulatory related employees appear to cost, on the average, 20% more than average employees, which is logical as these employees require special training and must have additional qualifications.

Table 28 Cost of Personnel for Environmental Compliance

% of Sales	1997	2004
<1	32.6%	24.5%
1-1.9	29.8%	26.4%
2-2.9	18.5%	26.4%
3-3.9	7.2%	7.7%
4-4.9	4.7%	6.4%
5-6.9	4.4%	5.2%
7-10	1.6%	2.6%
>10	1.1%	0.6%

Environmental Materials and Services

Costs of environmental materials and services (chemical, sludge disposal consultants, lab services, legal) are summarized in Table 29. These are displayed as a percentage of sales versus the percentage of the 156 respondents in each category. This equated to an average of 3.8% versus 3.3% seven years ago.

Table 29 Cost of Materials and Services for Environmental Compliance

% of Sales	1997	2004
<1	13.2%	7.7%
1-1.9	21.2%	19.9%
2-2.9	22.3%	25.0%
3-3.9	13.7%	12.2%
4-4.9	8.5%	9.6%
5-6.9	11.3%	14.1%
7-10	7.1%	3.8%
>10	2.7%	7.7%

OSHA/Safety and Health

The survey also looked into the annual OSHA/Safety and Health costs as a percent of sales revenue. Table 30 provides the response. There were 157 respondents who had an average of 2.2% of revenue compared with 1.1% from the last survey seven years ago. This is double the previous amount.

Table 30 OSHA/Safety and Health Compliance Costs

% of Sales	Response
<1%	52.8%
1-1.9%	29.3%
2-2.9%	15.9%
3-3.9%	1.3%
4-5%	0.6%
>5%	None

Average Compliance Expenditure

The compliance operating costs for an average job shop can be determined by adding the average costs from Tables 28, 29 and 30. The result can be seen in Table 31. Thus the average annual cost of compliance amounts to 8.4% of sales or $395,000 per year for the average shop with a sales volume of $4,700,000. This represents a 29% increase, when compared to the data collected seven years ago where the percentage for compliance was 6.5%.

Table 31 Average Compliance Operating Costs for Job Shops as a Percentage of Sales Revenue

Item	1997	2004
Environmental Payroll	2.1%	2.3%
Materials and Services	3.3%	3.9%
OSHA Safety and Health	1.1%	2.2%
Total	**6.5%**	**8.4%**

WAGES AND BENEFITS

Finishers were queried about pay rates, union participation, turnover and benefits for a variety of production positions. Low union participation and low turnover are still common, but wages and benefits have risen faster than inflation.

Union Participation

Respondents were asked for the status of their production staff relative to union membership. The results are shown in Table 32 . They reported that 6.5% of shops were unionized compared to 9.1% in 2000. A very small number (1.3%) reported a combination of union and non-union employees compared with 1.8% in 2000. The result is that 92.2% of job shops are non-union compared with 89.1% four years ago. This seems to indicate a small drop off in union participation.

Table 32 Union Membership for Production Employees

Status	2000	2004
Unionized	9.1%	6.5%
Combination	1.8%	1.3%
Non-Unionized	89.1%	92.2%

Temporary Employees

Respondents were asked about the current use of temporary employees versus two years ago. The 153 responses indicated that all use full-time employees, with 26.8% indicating the use of part-time employees and 29.4% the use of temporary employees. Of those who have used temporary employees, 18% indicate a increase in their use over the past two years. There were 35% that stated an decrease and 47% observed no change.

Compensation for Hourly Employees

Table 33 summarizes the responses to a question related to hourly pay rates for various production positions. The table also compares current job category responses with those from four years ago. Percentage increases vary from the lowest for rackers and tank operators (10-11%) to 18-19% for shop foremen and lab technicians, the highest. The increases are within the 4-year GDP inflation rate for the lowest wage earners, but double the rate for the highest.

Table 33 Average Hourly Pay Rates for Production Employees

Position	2000	2004	Increase
Tank Operator	$11.20	$12.40	11%
Lead Person	$14.00	$16.00	15%
Racker	$ 8.60	$ 9.50	10%
Polisher/Buffer	$12.00	$13.50	13%
Waste Treatment Operator	$13.10	$15.00	15%
Lab Technician	$14.70	$17.40	18%
QC Inspector	$14.20	$16.10	13%
Supervisor	$18.00	$20.80	16%
Shop Foreman	$20.60	$24.50	19%

Employee Benefits

Respondents were queried regarding benefits offered to salaried and hourly employees. Their responses are summarized in Tables 34 and 35. The results are each compared with similar data collected and reported four years ago. The vast majority of platers offer both salaried and hourly employees health insurance and paid vacations.

Table 34 Benefits Offered to Hourly Job Shop Production Employees

Benefit	2000	2004
Health Insurance	87.6%	87.7%
Paid Vacations	92.5%	97.4%
Retirement Plan	64.7%	61.3%
Dental Insurance	52.3%	44.5%
Sick Leave	37.6%	31.0%
Profit Sharing	38.0%	36.1%
Expense Accounts	2.6%	2.6%
Bonuses	60.2%	59.4%
Vision Plan	22.9%	25.8%
Automobile	2.6%	0.6%
Free Meals (1x/week)	6.0%	2.6%
Cafeteria Plan	12.4%	19.4%
Uniforms/Shoes	53.8%	66.5%

Table 35 Benefits Offered to Salaried Job Shop Production Employees

Benefit	2000	2004
Health Insurance	86.8%	85.8%
Paid Vacations	89.5%	87.7%
Retirement Plan	64.7%	61.9%
Dental Insurance	52.6%	41.9%
Sick Leave	44.7%	41.3%
Profit Sharing	42.1%	38.1%
Expense Accounts	27.8%	33.5%
Bonuses	67.7%	69.0%
Vision Plan	26.3%	23.9%
Automobile	20.7%	31.0%
Free Meals (1x/week)	7.5%	5.8%
Cafeteria Plan	12.0%	18.7%
Uniforms/Shoes	37.6%	40.0%

Hourly employees, compared with four years ago, have seen increases in paid vacations, vision plans, cafeteria plans and company-paid uniform benefits. The key reductions were found in dental insurance and sick leave.

The most significant shifts for salaried employees, within the last 4 years, were the increase in a company-paid car, cafeteria plans and expense accounts. The key reduction for salaried employees was in dental insurance.

Employee Turnover

Respondents were asked if employee turnover was a problem at their facilities. About 16% reported that hourly employee turnover was a problem. The average annual turnover rate for all respondents for hourly employees was 6%, while that for salaried employees was reported as 1.7%.

MARKETS AND CUSTOMERS

Several questions sought information on the markets served and profiles of customers. These included growth market areas and the physical location of existing customers. The reported number of customers is up. While customers are generally located close to the metal finisher, a surprisingly high number of metal finishers serve the international marketplace.

Industries Served

The industry market segments from 156 respondents are listed in order of percentage of shops involved in Table 36. The most frequently mentioned were general industry/machinery and fasteners. The market segment listed that was least likely to be served was sporting goods/toys. The average finisher serves seven different market segments.

Finishers were asked to project growth/shrinkage in the markets that they currently serve. For each market the questionnaire offered the following checklist: decrease substantially, decrease somewhat, stay the same, increase somewhat, or increase substantially over the next two years. A minimum of thirty-two responses (20%) was set as a cut off for inclusion in this portion of the report.

A growth index was defined by assigning a value of zero for decrease substantially, 50 for decrease somewhat, 100 for stay the same, 150 for increase somewhat and 200 for increase substantially. Thus an index of 100 would indicate a flat market was expected, values below 100 a shrinking market and values in excess of 100 a growing market.

Table 36 Industry Market Segments Served by Job Shops

Industry Segment	Percentage of Shops Serving
Machinery/Industrial	62.2%
Fasteners	61.5%
Computers/Communications/Electronics	58.3%
Automotive/Truck – Aftermarket	57.7%
Defense/Military/Government	57.6%
Hardware/Tools	57.1%
Medical	54.4%
Automotive/Truck – OEM	53.2%
Civilian Aircraft/Aerospace	48.1%
Appliances	47.4%
Furniture and Fixtures	45.5%
Plumbing Fixtures	39.7%
Pharmaceutical/Food	32.7%
Sporting Goods/Toys	28.8%

Table 37 Growth Index for Industry Market Segments Served by Job Shops

Industry Segment	Growth Index
Defense/Military/Government	124
Automotive/Truck – Aftermarket	122
Medical	121
Automotive/Truck – OEM	116
Civilian Aircraft/Aerospace	114
Machinery/Industrial	114
Pharmaceutical/Food	112
Computers/Communications/Electronics	103
Sporting Goods/Toys	100
Fasteners	99
Hardware/Tools	98
Appliances	97
Furniture and Fixtures	96
Plumbing Fixtures	92

Results are shown in Table 37. The highest ratings were for defense/military/government, automotive/truck aftermarket and medical followed by automotive/truck OEM and industrial/machinery. The lowest ratings (all below 100) were for plumbing fixtures, furniture/fixtures, appliances, hardware/tools and fasteners

Number of Customers

Respondents were asked how many different customers they served in 2004. These results are shown in Table 38. The average number of customers was 208 with the median being 174. Four years ago it was reported that job shops served an average of 195 customers.

Table 38 Number of Customers Served in 2004

Number	Percentage of Shops
<25	4.5%
25-100	23.3%
101-200	30.2%
201-300	19.5%
301-400	10.1%
401-500	5.7%
>500	6.9%

The percentage of new customers served in 2004 is shown in Table 39 with a comparison to the 2000 results. The average number of new customers was 8.5% compared to the 12.5% reported in 2000, a definite downward trend.

Table 39 New Customers Served by Job Shops

Range	2000	2004
<5%	23.3%	25.3%
5-10%	37.8%	52.5%
11-20%	22.2%	17.1%
21-30%	11.1%	5.1%
31-40%	2.6%	None
41-50%	1.1%	None
>50%	1.9%	None

The total sales contribution by the top 20% of customers was the subject of another question. This was a test of the familiar 80-20 Rule. These results are reported in Table 40. Both the average and median responses were 66%.

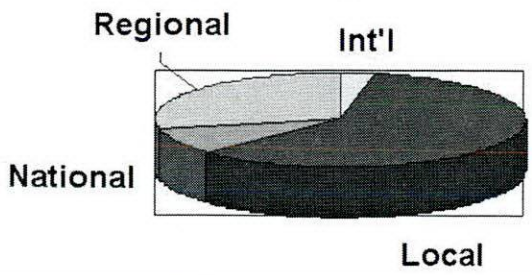
Table 40 Sales Contributed by Top 20% of Job Shop Customers

Percentage Contribution	Number Responding
20%	None
30%	3.8%
40%	7.0%
50%	5.1%
60%	19.0%
70%	25.9%
80%	39.2%

Customer Location

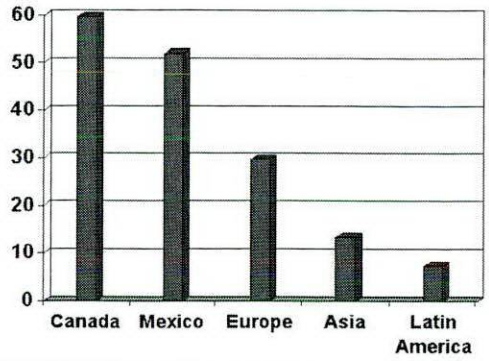
The respondents were asked to indicate the geographical location of the majority of their shops' customers. The results are summarized in Figure 11. Local was defined as 100 miles, regional as 100 to 500 miles and national as greater than 500 miles. Compared to data reported for 2000, the local category was the only area of increase, by 23.7%. The other categories all decreased versus 2000. This would seem to indicate that either finishers are focusing closer to home or that they are not providing pick-up and/or delivery services beyond local market areas.

Figure 11 Location of the Majority of Job Shop Customers



Finishers were asked to provide more details on their international customers. There were 41.6% of the responders who reported that they had international customers. The locations and their prevalence are given in Figure 12. As might be expected, Canada and Mexico are the leading locations for international customers. As this subject has not been researched before, a trend cannot be reported; however, it does seem that U.S. platers are doing a significant amount of metal finishing export business.

Figure 12 Location of Job Shop International Customers



Methods Used to Promote Business

Finishers were asked how they promote their services. Their responses are summarized in Table 41 and are compared with data reported 4 years ago. Note that responses add up to much more than 100% as shops generally use more than one method for promotion.

Table 41 Methods Used by Metal Finishing Job Shops to Promote Their Services

Method	2000	2004
Word of Mouth	-	90.3%
Shop Web Site	-	70.1%
Yellow Pages	50.4%	51.9%
Business Directories	48.5%	48.1%
Sales Reps	46.6%	48.1%
Direct Salesmen	45.8%	35.7%
Exhibit at Shows	25.4%	24.7%
Direct Mail	25.8%	23.4%
Commercial Web Sites	-	19.5%
Magazine Advertising	13.2%	9.7%

The most popular techniques reported this year include "word of mouth" and the finisher's own web site. Use of the company's own web sites has increased and is now the second most popular tool. Four years ago it was not even considered important enough to be included as a choice. Use of commercial web sites has dropped significantly, though four years ago this answer might have been included under a company's "own web site" answer. Another significant shift from four years ago is the 10% drop in the use of direct salesmen and a slight increase in the use of sales reps.

COMPUTER USAGE

Questions were posed to the finishers related to computer usage, applications and the use of the Internet. The data from 150 to 160 usable responses are reported in this section. Computer and Internet usage has certainly become an integral and important part of today's metal finishing business.

Computer Usage

The vast majority of finishers use computers and the Internet in the workplace. Table 42 provides the usage responses compared to 1997. It is not surprising that nearly 100% of finishers use computers and the Internet. Usage has increased dramatically over the past seven years.

Table 42 Computer Usage in Metal Finishing

	1997	2004
Use Computers	91.2%	98.1%
Have Internet Access	70.3%	96.8%

Job shop finishers continue to use computers for accounting and order entry as summarized in Table 43. Increased use of computers is indicated for all functions compared with 1997 including significant increases in computer usage for regulatory compliance information and process controls.

Table 43 Computer Applications Used by Metal Finishers

Task	1997	2004
Accounting/Billing	98.0%	98.1%
Order Entry	75.5%	82.1%
Job Quoting	63.6%	71.2%
Order Tracking	–	70.5%
Scheduling/Production	56.6%	64.1%
Quality Assurance	55.1%	63.5%
Regulatory Compliance	37.4%	62.8%
Process Control	12-18%	62.8%
Training	24.2%	37.8%

Internet Usage

As indicated above, 154 shops reported having Internet access at work. The Internet applications used by these finishers compared to seven years ago is summarized in Table 44. The dominant uses continue to be for E-mail and requests for product information... at a significant increase over the past survey. There is a slight drop off in chat lines and data base use indicated.

Table 44 Internet Applications Used by Metal Finishers

Tasks	1997	2004
E-mail	83.8%	96.7%
Product Information	71.1%	87.7%
Browsing	50.7%	55.8%
Purchase Products	20.4%	51.9%
Data Bases	33.8%	26.6%
Chat Lines	7.7%	1.7%

The frequency of current Internet/on-line use compared to 1997 is summarized in Table 45. These data are consistent with the trends reported above on increased Internet usage for many functions. Multiple Internet usage per day is by far the most popular use frequency.

Table 45 Frequency of On-Line Usage by Metal Finishers

Frequency	1997	2004
Several per Day	30.9%	71.0%
Once per Day	21.6%	12.9%
Several per Week	28.8%	11.6%
Once per Week	7.2%	3.8%
Less than Once per Week	11.5%	0.6%

Data on the finishers' use of various metal finishing industry web sites was obtained from 88 respondents and is compared to 1997 data in Table 46. Significantly, an increased use of the finishing.com, MFSA, NAMF and pfonline.com web sites is indicated. It is not surprising that the NAMF site is among the most popular since the NAMF membership was the source of the mailing list used.

Table 46 Most Popular Finishing-Related Web Sites

Site	1997	2004
aesf.org	30.3%	30.7%
mfsa.org	4.2%	19.3%
namf.org	24.6%	53.4%
nmfrc.org	15.5%	18.1%
finishing.com	34.5%	52.3%
metalfinishing.com	–	44.3%
pfonline.com	3.5%	22.7%
plateworld.com	–	5.7%

PROCESS TECHNOLOGY

Processes Employed

The significant processes employed by metal finishing job shops are shown in Tables 47 to 53. The figures are based on 149 responses. Each table indicates the percentage of shops utilizing a particular process and not the volume of use.

In comparing the results to previous reports, it will be found that once again decorative nickel is by far the most popular of the electroplating processes. Electroless nickel, cyanide copper, decorative hexavalent chromium and acid zinc round out the top five plating processes. The chromium plating processes show the widest increase in usage, especially decorative trivalent chromium. Zinc alloys have also increased in use. Among the non-plated finishes, hardcoat anodizing and electropolishing appear to have the broadest increases.

Process Eliminations

Respondents were asked to list any processes currently in use that they planned to or would like to eliminate within the next two years. There were 42 respondents who reported that they would, or would

Table 47 Copper and Copper Alloy Electroplating Processes In Use

Process	Percentage of Shops Using
Brass	18.1%
Bronze	11.4%
Acid Copper	26.2%
Cyanide Copper	36.2%
Non-Cyanide Alkaline Copper	10.1%

Table 48 Cobalt, Nickel, and Chromium Electroplating Processes In Use

Process	Percentage of Shops Using
Cobalt and Alloys	7.4%
Decorative Nickel	50.3%
Decorative Chromium (Hexavalent)	35.6%
Decorative Chromium (Trivalent)	22.1%
Hard Chromium (Hexavalent)	21.5%

Table 49 Tin and Tin Alloy Electroplating Processes In Use

Process	Percentage of Shops Using
Acid Tin	30.2%
Stannate Tin	13.4%
Tin-Lead	10.7%
Tin-Nickel	6.7%

Table 50 Cadmium, Zinc, and Zinc Alloy Electroplating Processes In Use

Process	Percentage of Shops Using
Cadmium	24.2%
Acid Zinc	33.6%
Cyanide Zinc	11.4%
Non-Cyanide Alkaline Zinc	21.5%
Zinc-Cobalt	10.1%
Zinc-Iron	7.4%
Zinc-Nickel	12.1%

Table 51 Precious Metal Electroplating Processes In Use

Process	Percentage of Shops Using
Gold	24.2%
Palladium and Alloys	4.0%
Rhodium	5.4%
Silver	27.5%

Table 52 Electroless Plating Processes in Use

Process	Percentage of Shops Using
Electroless Copper	4.7%
Electroless Nickel	36.9%
Electroless Palladium	1.3%

Table 53 Surface Treatment Processes in Use

Process	Percentage of Shops Using
Type I - Chromic Acid Anodizing	12.1%
Type II - Sulfuric Acid Anodizing	30.2%
Type III - Hardcoat Anodizing	23.5%
Conversion Coatings	50.3%
Electropolishing	14.1%
Pretreatments	42.3%
Strippers	40.9%

like to, eliminate a total of 50 process operations. By far the largest group of processes selected for elimination were 29 (58% of the total) based on hexavalent chromium.

Thirteen responses involved elimination of chromate conversion coatings. The reason given was to comply with the ELV directive of the European Union, which bans hexavalent chromium usage on vehicles. One of the twelve indicated they would like to eliminate chromate conversion coatings, but that some of their customers had not accepted the trivalent chromium alternatives.

There were 11 responses involving dropping decorative chromium plating operations. Six will do so, with two noting reduced demand, in one case using electroless nickel as a substitute. All six cited regulatory concerns as a major factor. Five additional respondents would like to eliminate hexavalent chromium plating, due to regulatory concerns, but mentioned that there were no acceptable alternatives or that sales were good.

Two finishers will eliminate hexavalent chromium based chemical film operations to meet European Union requirements. Another would like to drop the process, but had not found a satisfactory substitute. Two responses indicated an interest in dropping chromic acid anodizing; however, they had not obtained a suitable replacement.

Cyanide-based processes were the next highest in interest with ten processes (20% of the total) selected for elimination or favored for it. The six to be dropped included three cadmium plating lines, one brass line and two cyanide copper installations. All respondents mentioned environmental issues and one involved with cadmium also noted low demand. A further four responders would each like to eliminate cyanide-based processes. Three of these would drop cadmium, if they could, due to the cost of waste treatment and compliance. The final mention of cyanide concerned copper cyanide for which there was no suitable non-cyanide alternative.

Other plating processes were the subject of six (12%) of the responses. One stated he would eliminate all plating because "the government is out of control." Another will drop copper and nickel plating due to low demand in his market area. A gold plating system will be shut down as a result of low demand. One respondent will eliminate tin-lead plating and replace it with reflowed pure tin. Two responders would like to drop lead plating, but need it due to customer requests.

There was one finisher who will eliminate a manual powder coating facility due to consolidation. Another will drop a manganese phosphate line due to low demand. Elimination of a solvent-based coating machine was the desire of one respondent. Two responses concerned a wish to drop nitric acid based pretreatments for aluminum. These last three all noted environmental concerns.

Results of this survey were compared to those obtained in SFMRB Report No. 5, published in 1999. At that time cyanide-based processes dominated the process eliminations at 44%, compared to 20% in this report. Other plating processes were second with 19%, compared to 12% in this report. Hexavalent chromium processes were at 15%, compared to a high of 58% reported here. The reasons for process elimination in this report were overwhelmingly environmental. This was also the case in 1999.

Process Additions

There were 57 respondents who reported on 67 processes they would or would like to add to their facilities. The highest response of 16 (24%) was for zinc and zinc alloy plating. These included six rack zinc lines, which are being added to broaden services and raise competitiveness and five zinc-nickel installations, to meet a growing automotive market or to replace cadmium. One respondent indicated that he would like to add another zinc line, but doesn't have the space to fit it. Four would like to add zinc alloys (zinc-nickel or tin-zinc) due to increased demand.

Hexavalent chromium replacements were also high (15%) on the list of processes to be added. Six responses concerned trivalent chromium conversion coatings, one a trivalent chromium chemical film and another will use a hexavalent-chromium-free conversion coating on his new zinc line. One would like to replace a hexavalent-chromium-based chemical film, but found the chromium-free alternative would not meet the military specification.

Ten mentions (15%) of organic coating processes were made. Four of these were about electrocoating with three definite, due to business opportunities or growth and one on a wish list. Dip/spin coatings will be added by two respondents. Powder coating was the subject for two others. One will install a system including phosphate pretreatment due to a business opportunity. Another would like to do so, but is concerned about the availability of capital. There was one responder hoping to add a phosphate line. Another respondent would like to add organic coating due to customer demand, but did not specify the type of process.

Electropolishing lines, for stainless steel and/or aluminum, will be added by five respondents. All but one of these due to customer requests with the other to add some diversification. Four finishers will add electroless nickel systems. One of these will be of the cadmium-and-lead-free type and another an electroless nickel-PTFE composite. One firm will add a line for plating on stainless steel to meet a new market opportunity. Another will install an automatic bake oven to reduce labor and improve reliability.

Another 15 or so items, each a different process, will be installed. About a dozen of these items involved electroplating processes ranging from black nickel to tin. There were also another half-dozen items on wish lists, each a different process.

The results of this survey were again compared to those obtained in SFMRB Report No. 5, published in 1999. The top process additions reported at that time were electroplating at 40%, paint/powder at 13%, electroless nickel at 11% and conversion coating at 11%. In this report the comparable numbers are quite similar, with electroplating at 42%, conversion coating at 12%, organic (paint/powder) coating at 15%, electropolishing at 8% and electroless nickel at 6%. One difference was the breakdown on electroplating. In 1999 zinc and zinc alloys accounted for only 27% of the total for electroplating while in this report they account for 57%.

Growth Indexes

The respondents were asked to project growth/shrinkage regarding a variety of plating and surface treatment processes. For each process the questionnaire offered the following checklist: decrease substantially, decrease somewhat, stay the same, increase somewhat, or increase substantially over the next two years. A minimum of ten responses was set as a cut off for inclusion in this report.

A growth index was defined by assigning a value of zero for decrease substantially, 50 for decrease somewhat, 100 for stay the same, 150 for increase somewhat and 200 for increase substantially. Thus an index of 100 would indicate a flat market was expected, values below 100 a shrinking market and values in excess of 100 a growing market. The processes were grouped for presentation of the results and these are shown in Tables 54 to 59.

Table 54 Growth Indexes for Copper and Copper Alloy Electroplating Processes

Process	Index
Brass	96
Bronze	103
Acid Copper	124
Cyanide Copper	115
Non-Cyanide Alkaline Copper	127

Table 55 Growth Indexes for Nickel and Chromium Plating Processes

Process	Index
Electroless Nickel	142
Decorative Nickel	121
Decorative Chromium (Hexavalent)	107
Decorative Chromium (Trivalent)	156
Hard Chromium (Hexavalent)	111

Table 56 Growth Indexes for Tin and Tin Alloy Electroplating Processes

Process	Index
Acid Tin	128
Stannate Tin	108
Tin-Lead	91
Tin-Nickel	110

Table 57 Growth Indexes for Zinc and Zinc Alloy Electroplating Processes

Process	Index
Acid Zinc	125
Cyanide Zinc	109
Non-Cyanide Alkaline Zinc	130
Zinc-Cobalt	127
Zinc-Iron	136
Zinc-Nickel	156

Table 58 Growth Indexes for Other Electroplating Processes

Process	Index
Cadmium	104
Cobalt and Alloys	124
Gold	118
Silver	121

Table 59 Growth Indexes for Surface Treatment Processes

Process	Index
Type I - Chromic Acid Anodizing	106
Type II - Sulfuric Acid Anodizing	133
Type III - Hardcoat Anodizing	139
Conversion Coatings	108
Electropolishing	138

Table 60 Top Processes in Growth Index

Process	Index
Decorative Trivalent Chromium	156
Zinc-Nickel Alloys	156
Electroless Nickel	142
Type III - Hardcoat Anodizing	139
Electropolishing	138
Zinc-Iron Alloys	136
Type II - Sulfuric Acid Anodizing	133
Alkaline Non-Cyanide Zinc	130

Table 60 summarizes the top eight processes in growth index reported in Tables 54 to 59. The highest ratings were shared by decorative trivalent chromium and zinc-nickel alloys followed by electroless nickel, type III - hardcoat anodizing, electropolishing, zinc-iron alloys, type II - sulfuric acid anodizing and alkaline non-cyanide zinc plating. Growth in trivalent chromium plating is driven by environmental regulations. Zinc-nickel had a two-fold impetus, a combination of the automotive market and environmental concerns as a replacement for cadmium.

Once again the results of this survey were compared to those obtained in SFMRB Report No. 5, published in 1999. At that time the top eight growth processes included electroless copper, electroless nickel, tin-lead, alkaline non-cyanide zinc, zinc alloys, hardcoat anodizing, sulfuric acid anodizing and acid zinc. Electroless copper was not included in this report since fewer than ten responses were received.

The biggest change was in trivalent chromium, which did not reach the top eight level in 1999 and was tied for the top spot in this report. The zinc alloys, driven by the automotive market, were ranked fifth as a group of three in 1999. In this report the three are each included separately and ranked tied for first, eighth and tied for tenth. Electroless nickel and hardcoat anodizing have proven to have consistent growth.

FINISHING EQUIPMENT

Equipment Employed

Respondents were asked to note the number of lines of each type of plating/anodizing equipment used in their facility. Unfortunately, many misinterpreted the intent of the question and simply used a check in each box instead of placing a number. Table 61 summarizes the total number of plating and anodizing equipment lines used by the 100 metal finishing job shops responding to the survey in the intended manner. Not shown are 19 reel-to-reel (strip) lines. The average number of lines was 7.5 per facility.

Table 61 Plating/Anodizing Equipment Used in Job Shops

Type	Rack	Barrel	Rack + Barrel
Hand Line	189	43	36
Manual Hoist	127	81	42
Automated Hoist	71	64	10
Automated Return	52	13	3

Extent of Automation

The data in Table 61 were used to prepare Figures 13 through 17. Figure 13 gives the extent of automation in the job shops. It is not surprising that job shop choose flexibility with 69% of the lines operated being hand lines or manual hoists. Figure 14 the types of systems in use. The most utilized are rack lines. These account for 58.5% of the lines in operation.

Figure 13 Extent of Automation in Job Shops

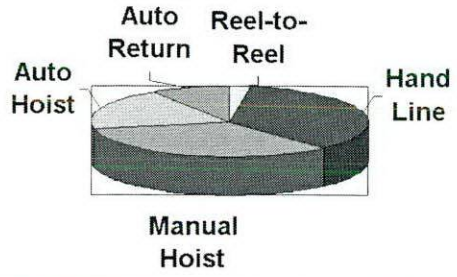


Figure 14 Types of Systems Used in Job Shops

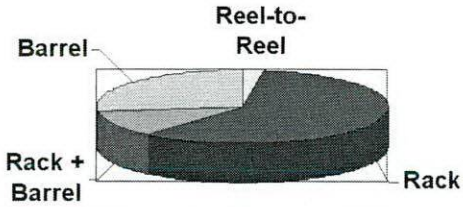


Figure 15 Rack Systems Used in Jub Shops

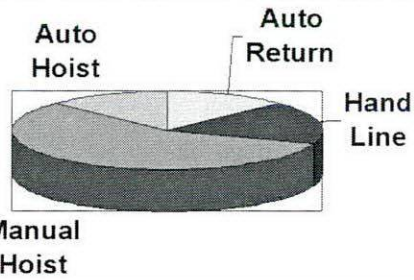


Figure 16 Barrel Systems Used in Job Shops

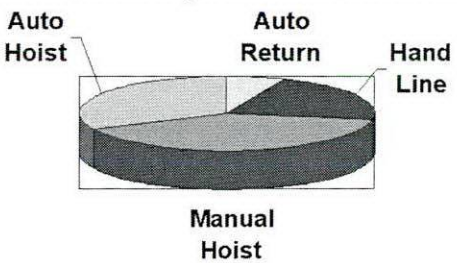
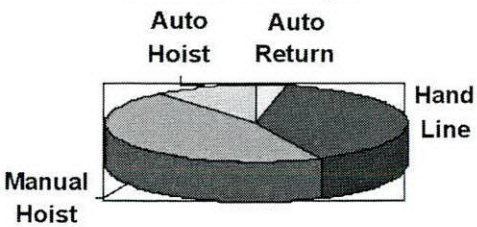


Figure 17 Mixed Rack Plus Barrel Systems Used in Job Shops



Barrels make up 27%, mixed racks and barrels 12%, and reel-to-reel systems 2.5%. Figures 15 and 16 provide breakdowns of rack and barrel systems, respectively. Hand lines are the most frequent for racks with 43% while manual hoists account for the most barrel systems with 40%. Figure 17 shows the breakdown for mixed use rack plus barrel systems. Most popular in the group is manual hoists at 46% followed closely by hand lines with 39.5%.

QUALITY CONTROL SYSTEMS

QC Certification/Registration

Job shop respondents were requested to complete two questions related to quality-control system practices. The first concerned whether their facilities held or planned to apply for a variety of certifications/registrations. There were 146 responses to this question. The results are shown in Table 62.

ISO 9000 is the most popular program with 37.7% presently certified and an additional 19.2% having applied or planning to apply. When this question was asked for the 1997-1998 report, the levels were considerably lower as seen in Table 63.

Table 62 Quality Levels Currently Held or Anticipated

	Certified/ Registered	Applied for	Plan to Apply
QS 9000	11.6%	None	4.8%
AS 9000	6.2%	2.1%	4.1%
ISO 9000	37.7%	3.4%	15.8%
ISO 14000	6.2%	2.1%	18.5%
NADCAP	11.0%	2.1%	9.6%

Table 63 Quality Levels Held or Anticipated as Reported in 1997-1998

	Certified/ Registered	Applied for	Plan to Apply
QS 9000	1.8%	6.0%	14.7%
AS 9000	<1%	<1%	2.8%
ISO 9000	9.6%	6.0%	23.4%
ISO 14000	<1%	<1%	8.7%
NADCAP	1.8%	<1%	1.8%

It's interesting to note that the total number of certifications, applications and planned applications in 1997-1998 for ISO 9000 closely match the number of actual certifications in 2005. (37.7% versus 39%). This is not true for the other quality systems, which either exceed or fall short of anticipated levels.

Quality Management Tools

The second question on quality control concerned the incorporation of business or quality management tools. Respondents were asked to check all the methods that applied from a list of a nearly a dozen. A total of 92 responses was received. The top choices are shown in Figure 18. Table 64 shows the complete results for all methods.

Figure 18 Most Popular Quality Management Tools

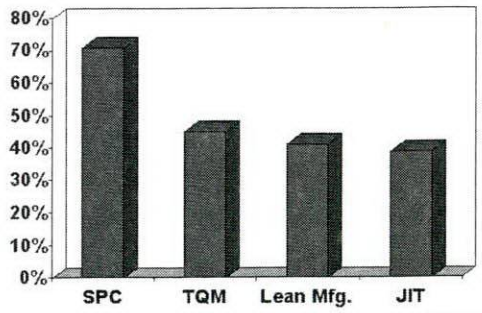


Table 64 Quality Management Tools Used by Metal Finishers

Tool	Percentage Utilizing the Tool
Statistical Process Control (SPC)	71%
Total Quality Management (TQM)	45%
Lean Manufacturing	41%
Just in Time (JIT)	39%
Six Sigma	14%
Flow Manufacturing	13%
Kaizen	12%
Enterprise Resource Planning (ERP)	5%
Theory of Constraints (TOC)	5%
Agile Manufacturing	2%
Transaction Processing System (TPS)	2%

As can be seen, Statistical Process Control (SPC) was the most popular with 71% of respondents utilizing this tool. There were 45% who reported using Total Quality Management (TQM), 41% using Lean Manufacturing and 39% using Just in Time (JIT). Three tools were reported to be used by just over 10% of respondents. These included Six Sigma, Flow Manufacturing and Kaizen. Enterprise Resource Planning (ERP) and Theory of Constraints (TOC) were each reported by about 5% of respondents and Transaction Processing System (TPS) and Agile Manufacturing were reported by 2%.

CHALLENGES FACING METAL FINISHERS

Overview

Metal finishers were requested to indicate the top three challenges to their businesses in the next few years. A dozen items were listed and each respondent was asked to mark the top three by using numerals 1,2 and 3 in order of the greatest challenges to be faced. The method used to evaluate these responses was to assign a value of 3 points to the number one challenge, 2 points to the number two challenge and 1 point to the number three challenge. In several cases, the respondent may have misunderstood the intent and simply checked three items without using the 1, 2, 3 designation. These were each assigned a value of two points. Similarly, if a respondent checked more than three items, the points were prorated to reflect a total of six. The items with the most points are shown in Figure 19. Responses from 159 finishers for all 12 items are listed in Table 65.

Figure 19 Top Rated Challenges to Metal Finishers

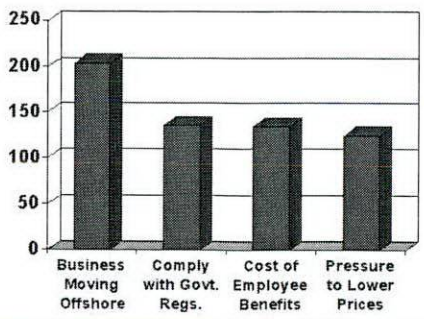


Table 65 Point Rating for Challenges Facing Metal Finishers

Challenge to Metal Finishers	Point Rating
Business Moving Offshore	205
Cost of Employee Benefits	139
Environmental Compliance	137
Pressure to Lower Prices	127
Changing Worker Safety Rules	94
Energy Price Increases	87
Metal Price Increases	43
Finding Qualified Labor	42
Domestic Competition	33
Improving Quality	22
Employee Training	12
Elimination of Various Finishes	10

By far the leading challenge to the average metal finisher is business moving offshore, which scored 205 points. This is followed by three closely bunched challenges: the cost of employee benefits (139 points), environmental compliance (137 points) and pressure to lower prices (127 points). Next were changing worker safety rules (94 points) and energy price increases (87 points). Further down the list were metal price increases (43 points), finding qualified labor (40 points) and domestic competition (33 points). Trailing the others were employee training (12 points) and elimination of various finishes (10 points).

In its 1997-1998 Report, SFMRB found the vast majority of metal finishers had environmental compliance as the number one challenge, finding qualified labor as number two and increased costs, domestic competition and foreign competition rounding out the top five. SFMRB Report No. 7, which addressed the automotive sector in 2001, listed the top five challenges to metal finishing job shops as pressure to lower prices, environmental compliance, business moving offshore, improving quality and elimination of various finishes.

Adjusting to Declining Sales

Declining sales in a poor economy require appropriate business adjustments. Respondents were asked to select from a list of methods those that apply to their firms. The results from 154 responses are shown in Table 66.

Table 66 Business Adjustments Made in Poor Economic Times

Method Employed	Percentage Using Method
Layoff Surplus Employees	73.4%
Redouble Sales Efforts	57.8%
Attempt to Enter New Market Segments	53.9%
Adjust Prices	52.6%
Introduce New Processes	39.6%
Automate to Reduce Labor Costs	27.2%
Merge with Another Company	4.5%

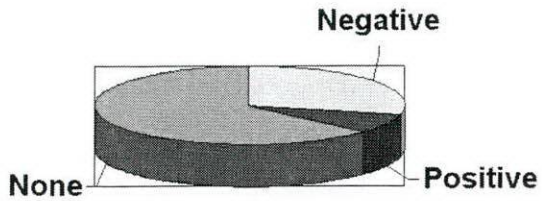
The finishers were provided an opportunity to write-in other methods that were not included in the questionnaire listing. Over a dozen added comments. Several mentioned improving customer service with one suggesting developing strategic alliances. Cutting costs and expenses along with waste reduction were reported. Three recommended variations to staff layoffs including freezing pay and reducing work hours. Improved productivity was noted by a couple of respondents as a viable method. One broached the subject of closure.

Effect of 9/11 on Metal Finishers

There is no question that the aftermath of 9/11 left many companies with losses due to a declining economy. Metal finishers were queried as to any additional positive or negative effect that 9/11 had on their businesses aside from the general loss to the economy. The results appear in Figure 20. There were 155 finishers that participated with 12 (7.8%) indicating a positive effect, 45 (29.0%) a negative effect and 98 (63.2%) indicating that there was not any further effect. Those who had either a positive or negative effect were encouraged to comment.

All 12 of the finishers who experienced a positive effect offered comments. Of these 9 (75%) reported

Figure 20 Additional Effects of 9/11 on Metal Finishers



that they received additional military sector work. Other comments included that added port security had slowed imports, price increases to customers were accepted and a reevaluation of the entire business was required.

There were 29 comments from the 45 reporting an additional negative impact. Ten of these concerned the economic conditions. Comments included "...economic impact was severe...", "...off 40%....", "...eighteen months of hell...", "...never fully recovered..." and "...customer base going under..." Seven of the 29 negative comments reported extreme losses due to their involvement with the airline repair industry. The airline industry was under heavy pressure. Five of the 29 noted high increases for insurance premiums. There were also five comments related to homeland security efforts, which made border crossings a major hassle, increased red tape and generally encouraged regulatory enforcement actions.

Collecting Receivables

Collecting receivables is often a challenge. Finishers were asked to check all the methods they use from a listing of six common procedures. The results from 154 finishers are shown in Table 67. They are given as a percentage of respondents who utilize each method and do not total to 100% since respondents usually checked more than one method.

The most popular methods to handle collection of overdue accounts are to place them on a COD basis (85.1%) and to hold work in progress until payment is made (81.2%). One-half of the respondents might cut-off the overdue account from future services. Just over 40% would consider making a personal visit to insist on payment. One quarter offer discount terms to encourage prompt payment of invoices while about 20% would consider hiring a collection agency.

Table 67 Methods Used to Collect Accounts Receivables

Method Employed	Percentage Using Method
Continue to Service on a COD Basis	85.1%
Hold Work in Progress until Paid	81.2%
Cut-off the Overdue Account	50.6%
Make a Personal Visit to Demand Payment	42.2%
Offer Discount Terms for Prompt Payment	28.6%
Hire a Collection Agency	21.4%

Twenty seven of the respondents provided write-in responses under the listing "Other." Two-thirds (18) of these stressed application of constant pressure in the form of frequent, regular phone calls. Three recommended utilization of legal action (small claims court). One would submit the information to a trade agency that publishes the names of poor payers.

Several finishers suggested a softer approach by working with clients who are in trouble. One would place them on a COD basis, but include an extra amount to pay down the overdue balance. Another would offer payment by credit card. One reported that collection was not considered a challenge.

Local and State Regulatory Actions

The next question asked if finishers had encountered any current or expected local and/or state regulations designed to exact revenue. There were 147 respondents of which 56 (38.1%) answered in the affirmative. These were also requested to explain their situation. Fifty one of the 56 responding affirmatively provided comments. Because of the volume of write-in responses and the localized nature of the query, the comments will be discussed on a state-by-state basis.

Since regulatory trends often start there and the largest number of respondents are from this state, the discussion will begin with California, or as one finisher lists it, the "People's Republic of California." Seventeen comments were received from the state. Five of these were of a general nature and referred to across-the-board examples. There were seven comments on the state's air permit fees citing either the California Air Resources Board (CARB) or Air Quality Management Districts (AQMD). As one responder stated, "The state is constantly proposing new assessments."

Two replies from California noted a 50% increase in CUDA fees to certify tanks ($400-$2,200). One characterized this as a tax. Several noted that the state had targeted the metal finishing industry for use of toxic materials. A core sampling of soil for traces of hexavalent chromium, which found nothing, was required of one finisher. And not to be omitted was mention of water district usage charges. There was also a city business license tied to revenue.

Five comments were included from other West Coast states, two each from Arizona and Washington and one from Oregon. One of the Arizona finishers indicated that the state had put pressure on all departments to "pay their own way." The other noted a substantial increase in county air quality fees. From Oregon the comment concerned continuing fee revenues for permits from local municipalities and the state to "...make their programs self-supporting." Puget Sound air quality permits to install new equipment were cited by one Washington finisher while another noted paying the highest fees yet for all the environmental agencies as well as the fire department.

The Midwest was represented with 15 comments. Five of these were from Michigan, one from Kentucky and three each from Illinois, Minnesota and Ohio. Two comments from Michigan concerned storm water permits. The Michigan single business tax was noted by two others. Increased monitoring fees were also mentioned.

Illinois respondents report that the state has increased license and registration fees related to the environment and trucks. The City of Chicago was cited as "always finding ways to extract revenues." Increases in water and sewer use fees were noted in Ohio. One finisher advised that he was required to install a fire sprinkler system by the local fire department in one Ohio community. In Kentucky, the sales tax has been interpreted to classify all items, except utilities and chemicals, as assessable.

The state of Minnesota has taken the tax burden from normal taxpayers and placed it on businesses according to one respondent. One locality's water agency has

imposed monthly storm water charges based on surface area rather than actual water volume Hennepin County was stated to have an initiative to increase inspections and enforcement. The state recently passed an administrative order, which gives the authority to assess $10,000 fines without due process.

Finishers from two southern states also provided comments. A Georgian noted that his state has imposed a hazardous waste fee of $21/ton. Two comments were forwarded from Texas metal finishers. One noted the local fire department and spill management. The other reported the need for permits for hazardous chemicals, flammable materials, storage, etc.

There were 11 responses from states in the Northeast. Four each from New York and New Jersey, two from Massachusetts and one from Pennsylvania. The three from New York noted that the state had imposed a dramatic surcharge on hazardous waste generators. One reported that the state claimed water used for processing was hazardous even though it was treated to meet the requirements of the local POTW. Another listed packaging regulations and fees on sanitation and use of the sidewalk.

Three respondents from New Jersey reported that high fees were widespread through all governmental agencies. One felt there was so much to comment upon that he suggested logging onto the state's website for further details. Another reported a fee based on weight for hazardous emissions. In Massachusetts one response noted that the Toxic Use Reduction Act (TURA) was a real "cash cow" for the state. The other comment from the state concerned increases in fees. The Pennsylvanian complained that other states and some cities tax metal finishers if they deliver parts with their own trucks.

Foreign Regulatory Actions

Metal finishers were asked if they have encountered any certifications or compliance requirements from outside the United States concerning their company, its processes, or products finished. A total of 147 responded, 40 of which (26.1%) indicated that they had. Thirty of the 40 included comments. Half of these (15) reported that they had been involved with ELV, there were nine that mentioned ROHS, eight with issues concerning hexavalent chromium, four with the European Union and two each with cadmium and lead. The total exceeded 30 items, since some mentioned more than one.

A note of explanation will be provided for those who may be unfamiliar with ELV and ROHS. ELV stands for the End-of-Life Vehicle Directive of the European Union. It is designed to minimize the environmental impact of vehicles that have reached the end of their useful life and are to be recycled or disposed of. The major coatings that are affected include chromate conversion coatings (especially those for zinc) and electroless nickel coatings, which include cadmium or lead as additives.

ROHS stands for the Restriction of Hazardous Substances Directive of the European Union. This is a complement to an earlier European Directive, WEEE, which stands for Waste Electrical and Electronic Equipment. The WEEE affects manufacturers, distributors and recyclers of electrical and electronic equipment containing lead, mercury, hexavalent chromium, cadmium and other substances. The ROHS forbids use of these materials in the manufacture of new electrical and electronic equipment with a few exceptions. Items affected include most tin-lead alloy deposits, cadmium deposits and hexavalent-chromium-based conversion coatings. Thus, all 30 of the comments pertain to directives of the European Union.

The bottom line is that metal finishers in North America and the rest of the world, will be required to meet environmental protection requirements of the European Union, if they wish to process parts intended for that market. Enforcement by the Union will not be needed as firms based outside of Europe will require their suppliers, such as metal finishers, to meet the foreign market regulatory objectives for exported products.

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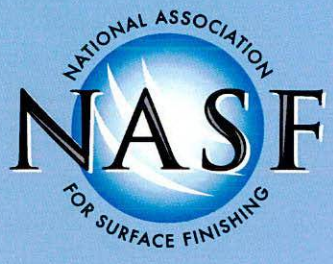
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Surveying NAFTA Market Trends

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METAL FINISHING INDUSTRY MARKET SURVEY

REPORT NO. 10

Surveying NAFTA Market Trends

This report is published under the auspices of the National Association for Surface Finishing (NASF) as a service to the Metal Finishing Industry and contains information based on actual historical data provided by member companies in the industry. Where quantitative projections are mentioned they are clearly identified as such.

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EXECUTIVE SUMMARY

Recognizing the need for accurate and relevant statistical information on the metal finishing industry, the National Association for Surface Finishing (NASF), proudly supports the Surface Finishing Market Research Board (SFMRB). The board is composed of association members, who meet periodically to discuss methods to accurately and efficiently gather data that is of interest and value to its members. Once the data collection methods are agreed upon, the SFMRB implements them and then compiles and publishes the results. This report is the 10th in a series. The initial report was completed in 1994. This report uses surveys of chemical suppliers and job shop electroplaters to report on NAFTA (North American Free Trade Act) trends in the metal finishing industry over the past few years.

This report is the most meaningful of the SFMRB publications because it is based on the most accurate collection and compilation of data on the NAFTA surface finishing industry ever attempted. Previous reports were based on smaller samples of data, that were also less representative of the overall industry. Scaling up these smaller samples to estimate the overall size of the NAFTA market led to unavoidable inaccuracies that this report corrects. Furthermore, this report is based on data that represents a significantly greater portion of the NAFTA market than had been available to the SFMRB Committee in the past. The availability of more representative data is due in large part to the creation of the National Association for Surface Finishing (NASF), which occurred in September of 2006.

The resulting consolidation that has taken place has enhanced the level of support for reports such as this. In turn, this has translated to a greater amount of meaningful data being submitted by its members. It is fair to ask, since Report #10 is based exclusively on data provided by the Tier I through Tier V NASF member companies, is it actually representative of the entire industry (i.e., NASF and non-NASF member companies)? The answer is, yes, and this is because the NASF member companies are truly representative of the entire industry, and also because they comprise a larger percentage of the total market than had participated in previous surveys. For example, this report, the supplier community (Tier I through Tier IV members) submitted data representative of at least 90% of the total proprietary chemical market for all of NAFTA. Similarly, finishers (Tier V members) provided data representative of at least 75% of the total market of what is spent for finishing services in the US market. This translates to significantly more reliable estimates of the overall size of the NAFTA finishing market, its total employment, as well as the overall size of the NAFTA proprietary chemical market.

Some of the key findings, which are further detailed in the text, tables, and figures of the report are as follows:

- The business outlook for NASF job shops is very optimistic.
- The greatest challenges to the finishing industry are pricing pressure and businesses moving offshore. Price pressure was the highest priority issue for the suppliers and the second highest issue for finishers. The reverse was true for business moving offshore.
- Based on reported sales volumes, the most popular plating processes are decorative nickel and electroless nickel. The two plating technologies projected to undergo the greatest growth are zinc-nickel alloy processes and decorative trivalent chromium processes.
- The average NASF job shop employs 51 individuals and does $5.2 million in annual sales.
- The automotive sector is still the largest single NAFTA market for finishers and their suppliers.
- In 2007, NAFTA shops are estimated to be only utilizing 88% of the finishing capacity they used in 2003.
- NAFTA annual proprietary plating chemical sales have increased 16% in the last four years to slightly less than $400 million.
- The average NASF job shop spends $385,000 per year for compliance with regulations. This is equivalent to 6.9% of the average finisher sales revenue.
- The largest chemical suppliers focus their marketing efforts on the top (i.e., largest) 20% of job shops.
- Nearly 80% of NASF Tier V member (job shops) operate their own web sites versus 70% four years ago.
- The number of job shops has steady declined since 2001, but the rate of decline has not been as significant in the last 2-3 years as in the previous 4-5 year period.
- One-third of NASF Tier V job shops under ISO 9000 registered management systems.
- The average size of NASF Tier V job shops has increased over the past few years, partly due to consolidation. These shops now each serve an average of 236 customers, an increase of nearly 20% compared to four years ago.

THE PURPOSE OF SFMRB

The metal finishing industry in North America has been faced with dramatic economic, technical, and regulatory challenges in recent decades. Industries subjected to these diverse pressures need reliable, statistical information in order to select the course of action that will ensure the best competitive advantage. The Surface Finishing Market Research Board (SFMRB) was created in 1991 to provide the necessary information regarding the market.

The SFMRB activities are directed by the National Association for Surface Finishing (NASF), which was founded and supported by the former members of the American Electroplaters and Surface Finishers Society (AESF), the Metal Finishing Suppliers' Association (MFSA), and the National Association of Metal Finishers (NAMF), all of which have now been assimilated into the NASF. The first two SFMRB reports, completed in 1994 and 1995, principally focused on the status of the metal finishing industry. The third, fourth, fifth, and sixth SFMRB reports, completed in 1997, 1998, 1999, and 2001, also reported on the industry status, but also included data on 10 areas of high interest to the sponsoring members. The seventh report, completed in 2002, covered trends in the automotive industry. The eighth report completed in 2004 focused entirely on the metal finishing chemical suppliers. The Ninth report, completed in 2005, covered the overall market trends of metal finishers.

This is the 10th report and includes data from both platers and chemical suppliers. But this report is much more than an update to the earlier reports published in 2004 and 2005. The data in this tenth report is much more relevant because of the significantly greater degree of participation by NASF members from the Tier 1 through Tier V categories. This greater degree of participation of chemical suppliers and job shops ensures much more reliable numbers.

METHODOLOGY

The cost of collecting data for the past reports was relatively high and the process was somewhat time consuming. The industry associations and trade publications supplied mailing lists. These lists included what are now both NASF and non-NASF member companies. Formerly, the NASF corporate members were associated with either the Metal Finishing Suppliers' Association (MFSA), or the National Association of Metal Finishers (NAMF).

Survey questionnaires were prepared and mailed to a selected portion of these lists, along with a cover letter to which a dollar bill was attached to further encourage participation. In some instances, over one thousand questionnaires were mailed. In order to assure confidentiality for the respondent, the services of a certified public accounting firm were used to compile the results and to provide the SFMRB with "sanitized data". This process delivered very statistically significant data and maintained a high degree of participant anonymity, but it was expensive. Final costs, including printing and other

outsourced activities ran into several tens of thousands of dollars, typically exceeding the amount recovered through the sales of the reports. Another disadvantage was that the sampling did not properly focus on the companies that represented the largest portions of the markets being studied.

This time the SFMRB decided to limit the data collection in order to conserve financial resources and also to speed up the data collection process. The SFMRB did this by focusing its efforts on collecting information from NSAF member companies in the Tier I through Tier V categories, i.e., the suppliers and the job shops. Twenty-seven suppliers of proprietary chemicals, representing a minimum of 90% of the total proprietary plating chemical sales in the NAFTA market, agreed to participate.

Likewise, last October, all 540 Tier V (job shop) NASF members received a detailed questionnaire that ensured a maximum amount of data for the survey, while preserving anonymity for participants. One hundred thirty nine (139) members returned completed surveys, guaranteeing the data collection was statistically meaningful.

To further assure anonymity would be maintained, an independent consultant was hired as the only person to see the individual surveys as they were submitted, and as the only person to interface directly with the proprietary chemical suppliers that submitted data.

Also, prior to finalizing this report, senior executives of several of the major chemical suppliers met in Washington, at their own expense, with members of the SFMRB report writing team. These industry leaders helped to validate the collected data and to provide additional suggestions for conclusions to be included in this report. Use of the term "SFMRB Committee"throughout this report refers to this group. Their input was invaluable and is highly appreciated.

SURVEY RESPONSES

As was previously mentioned, in October 2007, questionnaires specifically created to query the job shop community were mailed to each of the 540 NASF Tier V (job shop) members. The questionnaire covered topics such as sales, employment, cost of operations, markets served, processes offered and equipment employed, and impressions regarding the economic outlook for the next few years. A statistically significant number (139) of completed surveys were returned. Similarly, equivalent surveys applicable to the supplier community were sent to every Tier I through Tier IV NASF member that manufactures proprietary chemicals in North America. Twenty-seven of the 35 firms to whom surveys were sent returned completed surveys. An objective review of the eight firms that did not submit data showed they were not significant factors in the key proprietary areas that were measured.

Table 1 summarizes the number of respondents for the last several surveys, including this year's.

Table 1. Survey Response Compared to Previous Surveys

	2004	2006	2008	2008
	MFSA Suppliers	NAMF Job Shops	NASF (TIER I-V) Suppliers	NASF (TIER V) Job Shops
Number Mailed	17	579	35	540
Job Shop Responses	-	161	-	139
Supplier Responses	14	-	27	-
Response Rate	82%	27%	77%	26%

GENERAL INFORMATION FROM JOB SHOPS

Plant Locations

Table 2 lists the seven geographic areas used to group the job shop responses. They are broken down by percentage of plant sites in each of the U.S. regional areas and with comparisons to the previous three surveys. Responses to the first two surveys indicated that 40% of finishers were located in the East and West Central areas. This is not the case with this year's respondents, where it is roughly 25% less, but very consistent with the actual current Tier V membership distribution.

Table 2. Survey Response by Geographic Region

Region	1997	2000	2005	This Report	NASF TIER V Member Distribution
New England	10.4%	9.5%	6.2%	7.90%	7.60%
Mid Atlantic	12.7%	13.8%	14.2%	14.40%	17.6%
Southeast	6.4%	8.3%	4.9%	4.3%	2.8%
East Central	20.5%	19.0%	18.0%	-	15.7%
West Central	19.8%	20.9%	13.6%	12.20%	14.1%
Southwest	4.7%	7.9%	4.3%	7.2%	6.7%
West	25.4%	20.6%	39.5%	35.3%	34.6%

Employment

There were a total of 137 job shops that responded to this question. Their input indicates the average number of employees per shop is 51 and the median number is 30. Table 3 summarizes the employment levels that were reported for the job shops. Everyone employed at the location was included, i.e., sales, laboratory, part time, management, and shipping/receiving personnel.

Job shops that responded to previous surveys were typically smaller in size averaging 40 employees per facility with a mean number of employees of 17. The lower mean values relative to the averages, illustrates there was a larger concentration of small U.S. metal finishers with 10 or fewer employees in the past, compared to today. Also, from Table 3 and similar to 2004, the data from the latest respondents indicate that shops with 11-20, 21-30 and 31-50 employees are more of a factor than in the past. Saying this another way, today's shops of respondents are, on the average, nearly 30% larger than they were in 1997.

It is worth noting that the NASF Tier V member job shops that responded to the survey are among the largest shops in the United States. This point was also evident in previous SFMRB reports, where the average sales revenue of Tier V member shops (formerly known as NAMF members) was 30% higher than non-members. Interestingly enough, the Tier I-IV NASF members (i.e., the supplier members) believe this size disparity is even greater today than it was in the past. Most suppliers suggest the job shop population of the United States (the only country for which detailed data exists) are yet another example of the often quoted 80/20 rule. In this case, the suppliers believe that 20% of the US job shops represent 80% of the total chemical and equipment purchases. Further, they suggest the NASF Tier V members make up the vast majority of this 20% of the total number of shops that buy 80% of the chemicals and equipment.

Table 3. Number of Job Shop Employees

Number	1997	2000	2004	Current
1-2	with 3-5	4.70%	none	1.50%
3-5	13.6%	9.4%	2.4%	4.4%
6-10	14.7%	14.4%	9.9%	7.3%
11-20	17.8%	15.1%	19.3%	15.3%
21-30	12.7%	10.8%	20.0%	21.2%
31-50	16.7%	14.7%	16.8%	20.4%
51-75	9.4%	9.4%	9.3%	9.5%
76-100	6.7%	8.6%	6.8%	10.9%
101-200	7.5%	8.3%	12.4%	8.0%
>200	1.1%	1.4%	2.4%	2.9%

Facility Age

The questionnaire sent to the Tier V NASF members asked how many years their facility has been in operation. The 139 responses are summarized in Table 4. Note that a large majority (115) of the respondents indicate that their facilities have been in operation for over 25 years. This projects to over 80% of finishing facilities in the US being 25 or more years old. This may also be an independent indication that larger, older shops have purchased or taken the business from smaller shops that may have closed or reduced the scale on which they had done business. Unfortunately, it also indicates there are not many new finishing shops being built. This is additional confirmation the finishing industry is, at best, a stagnant segment of the overall market, at lease based on the number of new operations it attracts.

Table 4. Facility Age

Range in Years	Percentage Response
<2	0.0%
2-5	0.7%
6-10	1.4%
11-15	5.0%
16-25	10.1%
>25	82.7%

SHOP INFORMATION FROM SUPPLIERS

Number of Shops

The proprietary plating chemical suppliers were asked to estimate the number of plating job shops in the United States, Canada, and Mexico. Estimates varied widely, with some running as high as 9,500 job shops in the United States. At the other end of the spectrum, some suppliers (particularly those with limited product lines), estimated the number of job shops to be as low as 200. Ultimately, the SFMRB Committee agreed the best estimate of the number of US job shops was the one based on data submitted by the six largest plating chemical suppliers, i.e., 2,700.

The SFMRB Committee also agreed there are 425 job shops in Canada and 300 job shops in Mexico (See Table 5).

Table 5. NAFTA Job Shops

	Reported *	Validated
United States	2,758	2,700
Canada	418	425
Mexico	448	300
* Average of largest suppliers		

As has been the case with past SFMRB studies, suppliers have highly divergent opinions as to how many captive shops there are in North America. (By definition, in this report a captive shop is one that processes work in-house, as opposed to sending it to an outside finisher for processing. To further confuse the issue, there are some job shops that manufacture and finish many of their own parts, in addition to finishing parts sent to them by outside firms. Many of these shops consider themselves captive shops.) Here again, the SFMRB Committee concluded the averages submitted for the NAFTA region were incorrect and decided on the numbers shown in Table 6.

Table 6. NAFTA Captive Shops

	Reported *	Validated
United States	460	800
Canada	60	75
Mexico	200	260
* Average of largest suppliers		

Attrition

Based on the data submitted by respondents, the SFMRB Committee believes about 300 shops closed during the past 4 years in the area defined as the NAFTA market. On the positive side, however, the data also suggest the decline in the number of plating shops in North America since the year 2003, while steady, has not been as significant as the previous four year period.

Following are the explanations most commonly offered for the attrition that has taken place during the past four years.

- Continued movement of business to China and other Asian countries
- Bankruptcies
- Consolidations
- Unaffordable commodity prices, especially for nickel and other metals
- Ever-increasing pressure from customers to reduce prices

Environmental compliance costs, coupled with the above, are also reasons some companies chose to cease operating rather than make the capital investments necessary to comply with appropriate regulations and/or to be more efficient.

Capacity Utilization

The proprietary chemical suppliers were asked to estimate the current production capacity levels being used by their NAFTA metal finishing customers, and to compare these numbers to similar capacity estimates in the year 2003. The suppliers believe currently only 88% of the total production capacity of their customers is used versus 2003. This is an unexpected result since business has increased compared to what it was in 2003. The most likely explanation for this is that shops have learned to be more productive in the last few years, and also that many shops have invested in equipment specifically intended to improve their efficiency.

Size of the NAFTA Plating Market

SFMRB Report #10 uses a novel, yet reliable, method to estimate the size of the NAFTA finishing market, i.e., the total spent annually by companies purchasing plating and other finishing services, exclusive of painting/powder coating and phosphating. The method is based on the accepted rule-of-thumb that finishers typically spend 10% of sales revenue purchasing proprietary chemicals. Applying this rule of thumb to the total for NAFTA chemicals supplies (Table 22), the total NAFTA market for plating and finishing services would be $4.0 - 4.5 billion annually. Of this total, the US market for plating and finishing services is approximately $3.4-3.8 billion, the Canadian market is approximately $390- 400 million, and the Mexican market is approximately $280-300 million. It is appropriate to note the above estimate for the US market size includes the cost for plating and finishing services provided within the maquiladora business trade zone along the Mexican / United States border in California, Arizona, New Mexico and Texas. This was done because the suppliers that submitted detailed sales data typically included their sales to finishers in the maquiladora zone as part of their US sales.

Also, none of the three market size estimates include the cost of finishing with precious metals such as gold, silver, rhodium, etc. The surveys to both finishers and suppliers did not ask the specific questions that would have been needed to estimate the size of these markets.

It is appropriate to note these estimated sales totals for the total NAFTA market are lower than those mentioned in previous SFMRB reports. As was stated earlier, the SFMRB Committee is confident the numbers presented herein are more representative of the actual NAFTA sales volume for proprietary chemicals, as well as for plating and finishing services, than previously published. This is a direct result of having a larger database of accurate information from NASF Tier I through Tier V members (i.e., both suppliers and job shops) upon which to compile Report #10.

Previous reports have typically included an estimate of the number of individuals that are employed in the metal finishing market in North America. This has always been of value when discussing the industry with politicians. The employment estimate derived from the 2007 will be discussed later in this report.

CHEMICAL SUPPLY COMPANIES

Distributor Sales

Distributors continue to play an important role in supplying proprietary chemicals to North American electroplating shops. The data collected for Report #10 indicates that, on average, distributors process 29% of the total chemical sales to NAFTA finishers. Table 23 lists totals that reflect the proprietary chemical sales processed through distributors.

In certain instances, the density of plating operations in a given geography dictates that distributors are the most efficient means to satisfy customers' needs. In other instances, distributors provide the unique service of maintaining local inventory of chemicals (both basic and proprietary), equipment, as well as metals.

Another instance where distributors serve a unique role is acting as local, full-service suppliers to meet the growing need by OEM or Tier I type electroplating customers that require a total chemical management package. Distributors also fulfill a special role in providing an affordable method for foreign chemical and equipment manufacturers to enter the NAFTA market. The close relationships distributors typically have with their customers often provide the quickest and least expensive pathway for companies to introduce new foreign technology to the NAFTA finishing firms.

Finally, distributors provide chemical and equipment manufacturers with a viable means of fixing their costs to market their technology to existing and prospective customers in what is generally accepted to be a shrinking market. In this sense, it is exactly equivalent to the model Southwest Airlines popularized by contracting for most of their ground services, thereby fixing a significant portion of their cost to provide low-cost air travel to Southwest's customer base.

Supplier Employee Base

Table 7 summarizes the employment data submitted by 26 respondents to the questionnaires that were sent out by the SFMRB, and which has been extrapolated to project total employment figures for all the suppliers serving the NAFTA market. The companies were asked to provide employee numbers for three distinct groups: sales (field sales, including field technical service personnel), manufacturing, and administrative personnel. Similarly, the 2003 values were extrapolated to project the employees involved then. Please note the largest percentage of job loss was in the manufacturing area, where the reduction was 27%.

As stated previously, the SFMRB Committee is confident the 26 suppliers that contributed data for this part of the report constitute at least 90% of the total sales of proprietary plating chemicals to the NAFTA market. Therefore, it seems reasonable to use the employment figures for this 90% segment of the market to estimate the total employment for the proprietary chemical suppliers that serve the NAFTA market. Doing this suggests the entire chemical sector currently employs approximately 1,500 people, which is a reduction of approximately 13% from a similar extrapolation of 2003 data, and a reduction of over 23% by extrapolating 2000 data to estimate total employment at that time. It is very important to note three points:

(1) the supplier employment figures only refer to personnel that live in North America and directly serve the NAFTA market;

(2) there has not been any attempt to adjust these employment numbers to reflect the presence of staff personnel that are headquartered outside of the NAFTA area; and

(3) the employment figures do not include individuals employed by any of the non-proprietary chemical suppliers to the industry, such as equipment manufacturers, consultants, basic chemical manufacturers, and distributors.

The SFMRB Committee estimates the proprietary chemical suppliers only represent approximately one third of the total employment by the all suppliers to the finishing industry. Table 7 also includes an estimate of what this total employment number is for the entire supplier industry in North America.

Table 7. Employment* Proprietary Chemical Suppliers in this Survey

	2003	2007	% Change
Sales & Service Personnel	434	451	4%
Manufacturing	820	600	-27%
Administrative	493	460	-7%
Total Proprietary Chemical Supplier Employees	1,747	1,511	-13%
Total NAFTA Finishing Industry Supplier Employees	5,200	4,500	
** Includes part time employees*			

PROCESSES EMPLOYED BY JOB SHOPS

Processes Employed

The various processes offered by metal finishing NASF job shops (NASF Tier V members, in particular) are listed in Tables 8 to 14. The figures are based on 132 responses. A comparison with 2004 is included. Each table indicates the percentage of shops utilizing a particular process, but not the sales volume associated with the process.

Comparing the results from Report #10 to previous reports confirms that decorative nickel plating is still the most popular of the electroplating processes that are offered, and by a comfortable margin. Electroless nickel, cyanide copper, decorative hexavalent chromium, and acid tin round out the top five most popular plating processes. The chromium plating processes exhibit the largest increase in usage, with decorative trivalent chromium being the technology that has undergone the greatest increase in usage. Application of zinc alloy coatings is another growth area for electroplaters. In the case of non-plated finishes, hardcoat anodizing and electropolishing have undergone the greatest increases in popularity.

Table 8. Copper and Copper Alloy Electroplating Processes in Use

Process	2004	2007
Brass	18.1%	16.8%
Bronze	11.4%	7.6%
Acid Copper (not circuit board)	26.2%	28.2%
Cyanide Copper	36.2%	41.2%
Non-Cyanide Alkaline Copper	10.1%	6.1%

Table 9. Cobalt, Nickel, and Chromium Electroplating Processes in Use

Process	2004	2007
Cobalt and Alloys	7.4%	12.2%
Decorative Nickel	50.3%	54.2%
Decorative Chromium (Hex)	35.6%	41.2%
Decorative Chromium (Tri)	22.1%	26.7%
Hard Chromium (Hex)	21.5%	26.7%

Table 10. Tin and Tin Alloy Electroplating Processes In Use

Process	2004	2007
Acid Tin	30.2%	37.4%
Stannate Tin	13.4%	14.5%
Tin-Lead	10.7%	13.0%
Tin-Nickel	6.7%	5.3%

Table 11. Cadmium, Zinc, and Zinc Alloy Electroplating Processes In Use

Process	2004	2007
Cadmium	24.2%	23.7%
Acid Zinc	33.6%	32.1%
Cyanide Zinc	11.4%	14.5%
Alkaline Non-Cyanide Zinc	21.5%	20.6%
Zinc-Cobalt (Alkaline and acid)	10.1%	5.3%
Zinc-Iron	7.4%	7.6%
Zinc-Nickel	12.1%	13.0%

Table 12. Precious Metal Electroplating Processes In Use

Process	2004	2007
Gold	24.2%	29.0%
Palladium and Alloys	4.0%	3.1%
Rhodium	5.4%	10.7%
Silver	27.5%	30.5%

Table 13. Electroless Plating Processes in Use

Process	2004	2007
Electroless Copper	4.7%	4.6%
Electroless Nickel	36.9%	45.0%
Electroless Palladium	1.3%	0.8%

Table 14. Surface Treatment Processes in Use

Process	2004	2007
Type I -Chromic Acid Anodizing	12.1%	11.5%
Type II - Sulfuric Acid Anodizing	30.2%	31.3%
Type III - Hardcoat Anodizing	23.5%	22.9%
Electropolishing	14.1%	19.8%
Pretreatments	42.3%	51.9%
Strippers	40.9%	43.5%
Chromate Dip	-	51.1%

Growth Indexes

Job shop respondents were asked if they believe that the variety of plating and surface treatment processes will grow or shrink in popularity over the next two years. For each process the questionnaire offered the following choices: "decrease somewhat", "stay the same", or "increase somewhat" .

A Growth Index was defined by assigning a value of zero for "decrease somewhat", 100 for "stay the same" and 200 for "increase somewhat". Thus an index of 100 would indicate a flat market was expected, values below 100 a shrinking market, and values in excess of 100 a growing market. The processes were grouped for presentation of the results and are shown in Tables 15 to 20.

Table 21 summarizes the top six processes according to their respective Growth Index values. The highest rating was for zinc-nickel alloy finishes followed by decorative trivalent chromium. Type III - hardcoat anodizing, electroless nickel, electropolishing, and Type II - sulfuric acid anodizing follow. Table 21 also includes the results obtained in SFMRB Report # 9, published in 2004.

Table 15. Growth Indexes for Copper and Copper Alloy Electroplating Processes

Process	2004	2007
Brass	96	86
Acid Copper	103	130
Cyanide Copper	124	124
Non-Cyanide Alkaline Copper	115	125

Table 16. Growth Indexes for Nickel and Chromium Plating Processes

Process	2004	2007
Electroless Nickel	142	169
Decorative Nickel	121	138
Decorative Chromium (Hex)	107	124
Decorative Chromium (Tri)	156	183
Hard Chromium	111	143

Table 17. Growth Indexes for Tin and Tin Alloy Electroplating Processes

Process	2004	2007
Acid Tin	128	131
Stannate Tin	108	106
Tin-Lead	91	106
Tin-Nickel	110	129

Table 18. Growth Indexes for Zinc and Zinc Alloy Electroplating Processes

Process	2004	2007
Acid Zinc	125	138
Cyanide Zinc	109	116
Non-Cyanide Alkaline Zinc	130	144
Zinc-Cobalt	127	157
Zinc-Iron	136	150
Zinc-Nickel	156	188

Table 19. Growth Indexes for Other Electroplating Processes

Process	2004	2007
Cadmium	104	126
Cobalt and Alloys	124	156
Gold	118	153
Silver	121	160

Table 20. Growth Indexes for Surface Treatment Processes

Process	2004	2007
Type I - Chromic Acid Anodizing	106	140
Type II - Sulfuric Acid Anodizing	133	163
Type III - Hardcoat Anodizing	139	170
Electropolishing	138	165
Chromate Dip	-	136

Table 21. Top Processes in Growth Index

Process	Index
Zinc-Nickel Alloys	188
Decorative Chromium (Tri)	183
Type III - Hardcoat Anodizing	170
Electroless Nickel	169
Electopolishing	165
Type II - Sulfuric Acid Anodizing	163

PLATING PROCESSES SOLD

Major Processes

There are nine distinct plating process groups that are most frequently used to categorize the various proprietary products the major chemical suppliers offer. They are listed below.

- Decorative Chromium Products
- Electrolytic Nickel Plating Products
- Zinc Plating Products
- Copper Plating Products
- Tin and Tin Alloy Plating Products
- Electroless Processes
- Plastic Pre-plate Products
- Aluminum Finishing Products
- Hard Chrome Products

Generally these nine groups are further sub-divided into the 24 individual product categories formerly reported each quarter by the MFSA. Table 22 lists the sales for 22 of the 24 individual product groupings, plus a "catch-all" category that includes the sales of items such as soak and electro-cleaners, acid salts, metal strippers, etc. In the two instances where sales numbers were omitted for particular categories, the product sub-groupings were dominated by specific suppliers, and the SFMRB Committee decided it would be unfair to these suppliers to include sales information of a quasi-confidential nature in this report.

Please note Table 22 does not include any sales numbers for precious metal plating processes or precious metal salt concentrates, or proprietary chemicals used to fabricate or finish printed circuit boards (PCBs or PWBs).

Table 22. Proprietary Plating Process Chemical Sales for 2006-7

Process	2006 ($mil)	2007 ($mil)
Decorative Chromium Products – Proprietary Catalysts	8.1	8.6
Decorative Chromium Products – Mist Suppressants	3.1	2.9
Decorative Chromium Products – Trivalent Chromium Plating	3.7	3.4
Electrolytic Nickel Plating Products	38.2	36.2
Zinc Plating Products – Proprietary Cyanide	1.8	1.7
Zinc Plating Products - Proprietary Alkaline Non-Cyanide	9.5	10.7
Zinc Plating Products - Acid	15.1	15.6
Zinc Plating Products – Proprietary Agents for Alloy Zinc	8.1	8.4
Zinc Conversion Coatings – Proprietary Hexavalent	6.3	5.6
Zinc Conversion Coatings – Proprietary Trivalent	16.0	20.1
Zinc Conversion Coatings – Finish Coats & Sealants	4.7	6.2
Copper Plating Products – Prop. Agents for Cyanide Copper	1.0	1.0
Copper Plating Products – Prop. Agents for Acid Copper	9.2	9.3
Copper Plating Products – Prop. Agents for Alk. Non-CN Copper	1.6	2.0
Tin & Alloy Plating Products	37.4	34.6
Electroless Nickel – With Nickel Compounds & Reducers	49.1	54.8
Electroless Nickel POP	3.1	3.1
Electroless Nickel – Free of Lead and Cadmium	11.2	15.0
Copper Proprietary for Plating on Plastics	3.2	2.6
Plastic Pre-plate Products	11.0	10.8
Aluminum Finishing Products	16.4	15.5
Hard Chromium Plating Products*	30.9	30.0
Surface Conditioning (Strippers, Cleaners & Acid Salts)	91.3	93.9
Total	**380.0**	**392.0**

Total NAFTA Proprietary Chemical Sales

Table 23 lists the 2004 through 2007 total proprietary chemical sales volumes of the 27 survey respondents to NAFTA customers. The sales numbers include the 29% of the total sales that are processed through distributors. The second line in the table includes the adjustments needed to extrapolate to 100% of the NAFTA market, not just the portion reported by the 27 respondents. Finally, the year-by-year and 3-year changes in sales levels are included.

Table 23. Three Year Total NAFTA Proprietary Chemical Sales

	2004	2005	2006	2007
Total Sales Including Distributors	304	318	342	353
10% added for 100% of market	338	353	380	392
%/yearly gain		4.4%	7.6%	3.1%
Total 3-year % gain				16.0%

MARKETS SERVED

Suppliers

The annual NAFTA plating chemistry sales are allocated to the market segments shown in Table 24. The automotive, industrial, and electronics markets continue to be the dominant segments, which confirms earlier surveys. 60% of the fastener market segments was allocated to the machinery/ industrial sector and 40% to automotive OEM sector, as reported by the 2006 "Fastener Institute" annual report.

Table 24. NAFTA Plating Chemical Supplier Market Segments

Segment	Market Share
Appliances	4.9%
Automotive OEM (including light trucks & SUVs)	37.3%
Automotive Aftermarket	8.0%
Trucks	4.9%
Civilian Aircraft	2.3%
Computer/Communications/Electronics	10.0%
Defense/Military/Government	2.5%
Furniture/Fixtures/Lighting	3.8%
Hardware/Tools	5.5%
Machinery/Industrial Equipment	12.0%
Medical	1.5%
Pharmaceutical	1.0%
Plumbing Fixtures	4.1%
Sporting Goods	1.4%
Other	1.0%
Total	**100.0%**

Table 25 compares the current NAFTA industry segment percentages served by suppliers to the surveys conducted by SFMRB in the 1990's and in 2003. Past and current supplier survey responses were weighted to account for the size of the suppliers. The current survey used actual sales by each supplier to determine the size of each market segment. The automotive, machinery/industrial, and computer/electronics industries continue as the three largest industry segments served by finishers, with the automotive segment continuing to account for nearly half of the NAFTA electroplating business. Automotive OEM, aftermarket, and trucks have been grouped together into the automotive category.

It is important to remember this report does not include any estimates of the proprietary chemicals used in the wet processing of PCBs (PWBs). Adding a reasonable estimate of sales for this application to Table 25 increases the size of the computer/electronics market segment to where it would represent approximately 35% of the total NAFTA proprietary chemical sales for electroplating processes.

Table 25. Comparison of Chemical Supplier Markets Served (%)

Industry Segment	1992-1993	1996-1998	2003	2007
Appliances	---	6.0	5.8	4.9
Automotive	44.2	31.7	45.7	50.2
Civilian Aircraft	5.2	6.8	1.6	2.3
Computer/Electronics	11.0	15.1	18.6	10.0
Defense/Military	4.7	8.6	3.3	2.5
Furniture/Fixtures/Lighting	---	4.0	3.5	3.8
Hardware/Tools	---	4.0	5.1	5.5
Machinery/Industrial Equipment	3.9	9.6	8.0	12.0
Medical	---	---	---	1.5
Pharmaceutical	---	---	---	1.0
Plumbing/Fixtures	2.2	3.6	2.5	4.1
Sporting Goods/Toys	3.0	0.2	1.3	1.4
Consumer Durables	9.3	---	---	---
Other	16.5	10.4	4.4	1.0
	100%	**100%**	**100%**	**100%**

Note: Earlier surveys included the category "Fasteners" when doing this market segment analysis. To provide a more accurate delineation of actual numbers for the market segments in this report, these sales have been reallocated to the appropriate industry segments, namely Automotive OEM, Automotive Aftermarket. Trucks, and Civilian Aircraft.

Market Segments Served by Job Shops

The surveys also asked Tier V members to identify which of the market segments listed in Tables 24 and 25 they served.

The results of the 132 responders are shown in Table 26. It lists the percentage of respondents that indicated their firms serve each of the listed market segments. The segment mentioned most often was "Machinery/Industrial Equipment," and the segment mentioned least often was Sporting Goods/ Toys. The individual data that was submitted also indicated the average finisher serves seven different market segments. This is further evidence of the diversity of the typical Tier V job shop.

Table 26. Industry Market Segments Served by Job Shops

Industry Served	2004	2007
Machinery/Industrial Equipment	62.2%	72.7%
Fasteners	61.5%	67.4%
Defense/Military/Government	57.6%	65.2%
Medical	54.4%	56.1%
Civilian Aircraft/Aerospace	48.1%	55.3%
Computer/Communications/Electronics	58.3%	51.5%
Hardware/Tools	57.1%	51.5%
Automotive/Truck-OEM	53.2%	43.9%
Furniture and Fixtures	45.5%	42.4%
Automotive/Truck - Aftermarket	57.7%	40.2%
Trucks	-	40.2%
Appliances	47.4%	36.4%
Plumbing Fixtures	39.7%	36.4%
Pharmaceutical/Food	32.7%	28.0%
Sporting Goods/Toys	28.8	27.3%

The NASF job shop finishers were also asked if they believe the individual market segments will grow or shrink over the next two years. For each market segment, the questionnaire offered the following three choices: "decrease somewhat," "stay the same," or "increase somewhat."

As before, a Growth Index was determined by assigning a value of zero for "decrease somewhat," 100 for "stay the same," and 200 for "increase somewhat." Thus, a Growth Index of 100 would indicate a flat market was expected, values below 100, a shrinking market, and values in excess of 100, a growing market.

Table 27, summarizes the 132 responses that were received. The highest Growth Index ratings were Civilian Aircraft, Military, Auto/Truck, and Medical, followed by Machinery/Industrial Equipment and Pharmaceutical. The lowest ratings were for Plumbing and Appliances. It should be noted that some markets, such as Medical, start from a very small base, so significant growth is a logical assumption to make.

Table 27. Growth Index for Industry Market Segments Served by Job Shops

Industry Served	2004 Growth Index	2007 Growth Index
Civilian Aircraft/Aerospace	114	156
Defense/Military/Government	124	148
Medical	121	146
Machinery/Industrial Equipment	114	135
Pharmaceutical/Food	112	132
Fasteners	99	131
Automotive/Truck - Aftermarket	122	131
Trucks	-	130
Automotive/Truck-OEM	116	128
Hardware/Tools	98	124
Computer/Communications/Electronics	103	121
Sporting Goods/Toys	100	114
Furniture and Fixtures	96	113
Appliances	97	98
Plumbing Fixtures	92	98

JOB SHOP COSTS

In this section, general operating and capital expenditures for 2007 are reported for NASF Tier V members (i.e., job shop finishers). The data indicate there has been a definite trend toward higher operating costs and lower operating profits.

Capital Expenditures

The amount estimated for capital equipment expenditures in 2007 is shown in Table 28, as well as the percentage of shops in various sales revenue categories. This comparison indicates that there has not been a marked change relative to inflation since 1998. The 137 respondents averaged $155,000 in capital expenditures, with a median expenditure of $54,600.

Table 28. Capital Expenditures

$, Thousands	1998	2004	2007
<10	21.1%	22.0%	12.4%
10-24.9	18.3%	18.3%	19.7%
25-49.9	16.7%	16.7%	16.1%
50-99.9	16.1%	16.1%	20.4%
100-249.9	17.4%	17.4%	15.3%
250-499.9	5.0%	5.0%	9.5%
500-1,000	3.4%	3.4%	2.9%
>1,000	2.0%	2.0%	3.6%

Payroll

Table 29 summarizes the payroll expense distribution in Tier V job shops as a percentage of sales revenue and compares them to previous surveys. The median response percentage of sales revenue for payroll was 31% similar to earlier surveys (1994, 1995), which also reported median labor costs for job shops in the 28 to 32% range. The average payroll percentage of revenue in this survey was 28% compared to 28% in 1997 and 33% in 2004.

Table 29. Job Shop Payroll Costs

% of Sales	1997	2004	2007
<15	6.0%	0.6%	2.9%
15-19.9	13.7%	6.3%	9.4%
20-24.9	17.8%	6.3%	15.8%
25-29.9	18.9%	23.4%	18.0%
30-34.9	18.0%	16.5%	20.9%
35-40	15.3%	18.4%	17.3%
>40	10.4%	28.5%	15.8%

Selling and Administrative

Table 30 summarizes the selling and administrative (SG&A) expense distribution as a percentage of sales revenue and compares them to a past survey from seven years ago. The average percentage for SG&A in 2007 was 15.8% compared to 11.5% in 2004 and 11% in 1997. The median response was 9.5%, similar to 9.3% in 2004. This overhead type expense appears to be relatively constant for NASF job shops, though the average is slightly higher compared to the past.

Table 30. Job Shop Selling and General Administrative Expenses

% of Sales	1997	2004	2007
<15	with 5-9.9%	16.3%	28.7%
5-9.9	44.0%	38.6%	22.8%
10-14.9	31.8%	17.6%	22.1%
15-19.9	13.3%	12.4%	11.0%
20-24.9	4.1%	8.5%	7.4%
25-30	4.1%	5.2%	5.1%
>30	2.7%	1.3%	2.9%

Finishing Materials (i.e., Total Chemical Purchases, Including Proprietary Chemicals, as well as Basic Chemicals, Maintenance Supplies, etc.)

Table 31 categorizes Tier V member shops according to the percent of sales revenue they spend on Finishing Materials. A more detailed analysis of the specific individual data that was submitted indicates the average Tier V job shop spends 13.8% of sales revenue on Finishing Materials, which is extraordinarily close to the median value of 13.6%. The data reported for 2007 is consistent with past surveys.

At first glance the 13.8% figure may appear to contradict the rule-of-thumb mentioned earlier in this report that "the typical shop spends 10% of sales revenue on chemical purchases." The difference is simply a matter of the amount spent for proprietary chemicals, versus what is spent for total chemical purchases, as described in the section heading for the portion of the report.

Table 31. Cost of Finishing Materials

% of Sales	1997	2004	2007
<5	7.5%	7.1%	8.0%
5-9.9	30.6%	23.7%	18.8%
10-14.9	27.2%	32.7%	29.0%
15-19.9	18.5%	17.9%	16.7%
20-25	11.6%	7.1%	15.2%
>25	4.6%	1.3%	12.3%

Building Expense

Table 32 categorizes Tier V member shops according to the percent of sales revenue they spend on Building Expense (Rent/Mortgage). More specifically, the average Tier V member spends 4.9% of sales revenue on Rent/Mortgage. This is 1.4% higher than the 3.5% reported in 2004. The median Rent/Mortgage expenditure was 3.1%, the same as in 2004.

Table 32. Building Costs (Rent/Mortgage) for Job Shops

% of Sales	1997	2004	2007
<1	With 1-1.9 below	30.1%	28.3%
1-1.9	33.4%	9.0%	8.7%
2-3.9	24.4%	19.2%	23.9%
4-5.9	19.9%	25.0%	18.1%
6-7.9	9.3%	9.0%	12.3%
8 to 10	8.2%	4.5%	5.1%
>10	4.8%	3.2%	3.6%

Maintenance

Maintenance costs for the Tier V members are summarized in Table 33. They are grouped according to the percent of total respondents whose Maintenance Costs correlate to a defined range of percentages of sales revenue. The average value was 3.8%, compared to 4.5% in the last survey. The median value was 3.6%. This Maintenance Cost data is consistent with past reports. However, it is also unexpected since it indicates a reduction in maintenance costs. The only explanation the SFMRB

Committee could offer is that some job shops may have (temporarily) suspended routine maintenance expenditures in an attempt to regain lost profits from the past few years.

Table 33. Job Shop Maintenance Costs

% of Sales	1997	2004	2007
<2	16.2%	12.7%	20.9%
2-3.9	34.9%	35.4%	35.3%
4-5.9	31.6%	27.2%	23.7%
6-7.9	8.6%	13.9%	8.6%
8-10	7.3%	9.5%	8.6%
>10	1.4%	6.3%	2.9%

Utility Services

Table 34 categorizes Tier V member shops according to the percent of sales revenue they spend on Utility Services. The average cost Tier V members spend for their Utility Services is 7.9%, compared to 6% in 1997 and 7.3% in 2004. This represents a staggering 33 % increase in this expense category over the past ten years. This increase is even more staggering in light of the investment almost all shops have made in reducing energy consumption via things such as: (1) use of lower temperature cleaners; (2) installation of higher efficiency boilers and improved methods of handling the return of steam condensate; (3) wider usage of insulation on heated tanks; (4) etc. . The median expenditure for Utility Services was 6.6%.

Table 34. Job Shop Utility Costs

% of Sales	1997	2004	2007
<3	11.8%	6.3%	4.3%
3-4.9	25.0%	19.6%	22.5%
5-6.9	28.5%	27.2%	29.0%
7-9.9	21.0%	24.1%	21.0%
10 to 12	9.4%	13.3%	12.3%
>12	4.3%	9.5%	10.9%

Un-recovered Shipping Costs

Table 35 illustrates that about 50% of the job shops have un-recovered shipping costs that are below 1% of sales revenue. By definition, these un-recovered shipping costs are over and above those charged to customers. The average total cost was 1.5% of sales revenue, as compared to 1.4% as reported in the 2004 survey. This result is lower than anticipated in light of the drastic increase in fuel prices that has occurred in the last two years. The SFMRB Committee believes the data indicate Tier V NASF members have, out of economic necessity, passed on a greater percentage of their actual shipping costs to their customers, thereby minimizing their un-recovered shipping costs.

Table 35. Job Shop Shipping Costs (Not Billed to Customer)

% of Sales	2004
zero	12.3%
<1	36.9%
1-1.9	20.8%
2-2.9	18.5%
3-3.9	3.8%
4 to 5	2.3%
>5	5.4%

Benefits

Tables 36 through 39 summarize what NASF Tier V members' employee benefit costs are for health care, workmen's compensation, other insurance, and education/training. In these tables, members are grouped in each benefit category by the cost of this benefit as a percentage of annual sales revenue. Also, the 2007 survey results are compared to 1997 and 2004 survey results. With the exception of Education and Training Costs, all the remaining cost categories reflected a substantial increase in the cost of providing one of the specified employee benefits. Please note that in these tables, an increase in the cost of a specific category shows up as a decrease in the percentage of shops where the cost of that benefit is within the listed percentages of sales revenue.

This is best illustrated by referring to Table 36, which shows Health Care Costs were less than 1% of sales revenue for 13.9% of the 1997 survey respondents. By 2004 Health Care Costs had increased to where only 8.3% of the 2004 respondents could purchase employee health care insurance for less than 1% of sales, and by 2007, this number had dropped to 5.0%.

Table 36. Job Shop Health Care Costs

% of Sales	1997	2004	2007
<1	13.9%	8.3%	5.0%
1-1.9	23.1%	10.9%	15.1%
2-2.9	25.8%	19.9%	17.3%
3-3.9	19.7%	19.2%	22.3%
4 to 5	10.6%	21.2%	16.5%
>5	6.9%	20.5%	23.7%

Table 37. Job Shop Workmen's Compensation Costs

% of Sales	1997	2004	2007
<1	16.9%	14.8%	5.0%
1-1.9	39.9%	29.7%	15.1%
2-2.9	22.2%	26.9%	17.3%
3-3.9	10.5%	11.0%	22.3%
4 to 5	7.2%	1.9%	16.5%
>5	3.3%	14.2%	23.7%

Table 38. Other Job Shop Insurance Costs

% of Sales	1997	2004	2007
<1	25.6%	17.3%	21.5%
1-1.9	39.7%	32.1%	29.6%
2-2.9	15.4%	16.7%	27.4%
3-3.9	8.0%	15.4%	8.1%
4 to 5	6.3%	10.3%	3.7%
>5	5.0%	8.3%	8.9%

Table 39. Job Shop Education and Training Costs

% of Sales	1997	2004	2007
<1	62.8%	67.3%	66.7%
1-1.9	25.3%	25.0%	21.5%
2-2.9	8.8%	7.1%	8.1%
3-3.9	1.9%	0.6%	4.4%
4 to 5	1.1%	none	none

The comparative averages for health care, workman's compensation, education, and other insurance are shown below in Table 40.

Table 40. Average and Median Values for Various Costs

	1997	2004	2004	2007	2007
	Average	Average	Median	Average	Median
Health Care	2.6%	3.5%	3.5%	3.5%	3.6%
Workman's Comp.	2.1%	2.6%	2.2%	2.2%	1.9%
Other Insurance	1.9%	2.4%	2.0%	2.1%	1.9%
Education Training	1.0%	0.9%	0.7%	1.0%	0.8%

JOB SHOP COMPLIANCE COSTS

Employees

Table 41 lists the cost of employees whose primary responsibilities are in the regulatory and compliance area. The data lists, as a percentage, the number of companies where regulatory and compliance employee costs are within a specified range of percentages of sales revenue.

The average is 2.1% of sales revenue, as compared to a 2.1% rate seven years ago, and a 2.3% rate three years ago. This means that an average job shop now expends 7.4% of its total payroll cost on regulatory-related employees, versus 7.5% seven years ago and 6.8% three years ago. (This average was calculated by dividing the above 2.1% by the average job shop payroll expenditure of 28.3% that has been reported earlier in this compilation of data.) The data also suggest the cost for employees whose primary responsibilities are in regulatory and compliance areas are 20% higher than the company-wide average. This is not unexpected since these employees require special training and must have additional qualifications, compared to the average employee.

Table 41. Cost of Personnel for Environmental Compliance

% of Sales	1997	2004	2007
<1	32.6%	24.5%	32.8%
1-1.9	29.8%	26.4%	27.0%
2-2.9	18.5%	26.4%	19.0%
3-3.9	7.2%	7.7%	6.6%
4-4.9	4.7%	6.4%	10.2%
5-6.9	4.4%	5.2%	2.2%
7 to 10	1.6%	2.6%	0.7%

Environmental Materials and Services

The costs a Tier V job shop typically incurs purchasing Environmental Materials and Services (chemicals, sludge disposal, consultants, lab services, legal fees, etc.) are summarized in Table 42. Shops are grouped according to the percent of their total sales revenue they spend on these items. A more detailed analysis of the data submitted by the 135 respondents indicates shops spend an average of 3.7% for these items, versus 3.3% 10 years ago. The growth of these costs slightly exceeds inflation.

Table 42. Cost of Materials and Services for Environmental Compliance

% of Sales	1997	2004	2007
<1	13.7%	7.7%	8.1%
1-1.9	21.2%	19.9%	22.2%
2-2.9	22.3%	25.0%	20.7%
3-3.9	13.7%	12.2%	16.3%
4-4.9	8.5%	9.6%	8.1%
5-6.9	11.3%	14.1%	12.6%
7 to 10	7.1%	3.8%	6.7%
>10	2.7%	7.7%	5.2%

OSHA/Safety and Health

The survey also included questions aimed at measuring the amounts Tier V job shops spend annually on OSHA/Safety and Health concerns. Table 43 summarizes the data submitted by the 138 firms that responded to this part of the survey. The table uses the same grouping of respondents according to their expenditures as a percent of the total sales revenues. The average shop spends 1.1% of sales revenue on these items, compared with 2.2% from the 2004 survey. The 1997 survey indicated the same 1.1%.

Table 43. OSHA/Safety and Health Compliance Costs

% of Sales	2004	2007
<1	52.8%	60.1%
1-1.9	29.3%	24.6%
2-2.9	15.9%	8.0%
3-3.9	1.3%	5.8%
4-4.9	0.6%	0.7%
>5	none	0.7%

Summary

The total compliance costs for an average NASF job shop can be determined by adding the average costs from Tables 41, 42, and 43. Thus, the average annual cost of compliance amounts to 6.9% of sales or $358,000 per year for the average NASF job shop with a sales volume of $5,200,000. Remembering that the average Tier V job shop employs 51 persons, it's easy to calculate the sales per employee for the average job shop are $102,000.

JOB SHOP WAGES AND BENEFITS

Respondents were asked about pay rates, union participation, employee turnover, and benefits for the different production positions. Low union participation and low turnover is still common, but wages and benefits have risen faster than inflation, which translates to reduced operating profits for many job shops.

Compensation for Hourly Employees

Table 44 summarizes the responses to a question related to hourly pay rates for various production positions. The table also compares current job category responses with those from three and seven years ago and gives the seven-year percentage increase in hourly compensation for each category. Percentage increases vary from the lowest (17%) for polisher/buffer and QC inspectors up to 26-27% for lead persons and supervisors. The smaller increases are within the seven-year GDP inflation rate for most categories. Double the seven-year inflation rate seems to have applied for lead persons, supervisors, and foreman.

Table 44. Average Hourly Pay Rates for Production Employees

Position	2000	2004	2007	Increase (7 year)
Tank Operator	$11.20	$12.40	$13.34	19.1%
Lead person	$14.00	$16.00	$17.87	27.6%
Racker	$8.60	$9.50	$10.09	17.3%
Polisher/Buffer	$12.00	$13.50	$14.04	17.0%
Waste Treatment Operator	$13.10	$15.00	$15.73	20.1%
Lab Technician	$14.70	$17.40	$18.29	24.4%
QC Inspector	$14.20	$16.10	$16.61	17.0%
Supervisor	$18.00	$20.80	$22.85	26.9%
Shop Foreman	$20.60	$24.50	$25.74	25.0%

Employee Benefits

Respondents were queried regarding fringe benefits they offer to salaried and hourly employees. Their responses are summarized in Tables 45 and 46 below. The current reported results are each compared with similar data collected and reported four and seven years ago.

The following generalizations can be made: (1) the percent of companies offering specific benefits has remained relatively constant in the 2000, 2004, and 2007 surveys; (2) in this same period there has been a modest decrease in the percentage of companies that offer profit sharing; (3) in this same period more companies now offer a vision plan as part of the standard benefit package; (4) more companies currently provide company automobiles than in the previous two surveys; and (5) more and more companies have implemented cafeteria plans where employees select the benefit package items that are most important to them, and eliminate those of less importance.

Table 45. Benefits Offered to Hourly Job Shop Production Employees

Benefit	2000	2004	2007
Health Insurance	87.6%	87.7%	90.6%
Paid Vacations	92.5%	97.4%	95.7%
Retirement Plan	64.7%	61.3%	60.1%
Dental Insurance	52.3%	44.5%	52.2%
Sick Leave	37.6%	31.0%	31.2%
Profit Sharing	38.0%	36.1%	31.2%
Expense Accounts	2.6%	2.6%	3.6%
Bonuses	60.2%	59.4%	58.0%
Vision Plan	22.9%	25.8%	34.1%
Automobile	2.6%	0.6%	0.7%
Free Meals (1x/week)	6.0%	2.6%	2.9%
Cafeteria Plan	12.4%	19.4%	20.3%
Uniforms/Shoes	53.8%	66.5%	59.4%

Table 46. Benefits Offered to Salaried Job Shop Production Employees

Benefit	2000	2004	2007
Health Insurance	86.8%	85.6%	89.1%
Paid Vacations	89.5%	87.7%	90.6%
Retirement Plan	64.7%	61.9%	60.1%
Dental Insurance	52.6%	41.9%	52.9%
Sick Leave	44.7%	41.3%	40.0%
Profit Sharing	42.1%	38.1%	38.4%
Expense Accounts	27.8%	33.5%	26.1%
Bonuses	67.7%	69.0%	72.5%
Vision Plan	26.3%	23.9%	33.3%
Automobile	20.7%	31.0%	32.6%
Free Meals (1x/week)	7.5%	5.8%	5.8%
Cafeteria Plan	12.0%	18.7%	19.6%
Uniforms/Shoes	37.6%	40.0%	37.0%

The respondents also reported that overall employee benefits currently cost the job shops 18% of payroll, excluding FICA and Workman's Compensation. This is an increase of 1.6% over the results in the 2004 survey.

Employee Turnover

Respondents were asked if they felt hourly employee turnover was a problem and to specify their annual employee turnover rates for all positions. Only 22% of the respondents (versus 16% in 2004) indicated they believed turnover for hourly workers was a problem for them. The average turnover rate for hourly employees was 7%, compared to 6% in the 2004 survey. The average turnover rate for salaried employees was reported at 1.5%, the same as in 2004.

JOB SHOP CUSTOMER PROFILES

The Tier V members were asked to provide information on their customers, such as the total of firms with whom they did business on a regular basis, the distance these accounts are from their shops, and the degree of international business they did.

Number of Customers

Respondents were asked how many different customers they served in 2007. These results are shown in Table 47, where the percentage of shops for each category is shown. The average number of customers was 236, versus 208 in 2004 and 195 in 2000. The median number of customers was 195, versus 174 in 2004. There are at least two explanations for the increase in the reported number of customers: (1) larger shops have bought some of the smaller shops, thus inheriting many new customers; and (2) it's well accepted that many firms that previously had captive plating operations have closed them and are now sending their work to job shops for processing.

Table 47. Number of Job Shop Customers Served in 2007

Range	2004	2007
<25	4.5%	2.3%
25-100	23.3%	17.4%
101-200	30.2%	31.8%
201-300	19.5%	19.7%
301-400	10.1%	12.9%
401-500	5.7%	4.5%
>500	6.9%	11.4%

Table 48 summarizes respondents' input regarding any new customers with whom they were doing business, compared to 2004, and 2000. The average number of new customers was 8.0% for 2007, compared to 12.5% reported seven years ago, and 8.5% four years ago. Unfortunately, no questions were asked regarding lost customers, so it is impossible to know what the net effect of customer movement has had on overall sales volume.

Table 48. New Customers Served by Job Shops

Range	2000	2004	2007
<5%	23.3%	25.3%	31.6%
5-10%	37.8%	52.5%	43.4%
11-20%	22.2%	17.1%	20.6%
21-30%	11.1%	5.1%	2.9%
31-40%	2.6%	none	0.7%
41-50%	1.1%	none	0.7%
>50	1.9%	none	none

Respondents were also asked to estimate the total sales contribution of their top 20 % of customers. Table 49 summarizes these results. Both the average and median response were that 66% of the respondents' total sales come from the top 20% of their customers, exactly the same as reported in 2004. The fact that the number is the same as it was 3 years ago is almost as unusual as the fact that it is a clear and significant exception to the 80:20 rule.

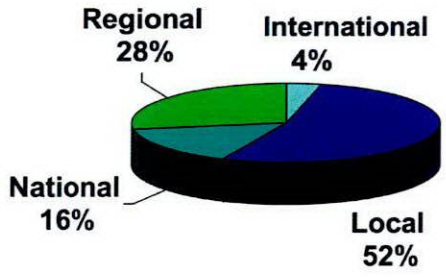
Table 49. Sales Contributed by Top 20% of Job Shop Customers

Percentage Contribution	2004	2007
20%	none	3.7%
30%	3.8%	3.0%
40%	7.0%	4.4%
50%	5.1%	6.7%
60%	19.0%	16.3%
70%	25.9%	25.9%
80%	39.2%	40.0%

Customer Location

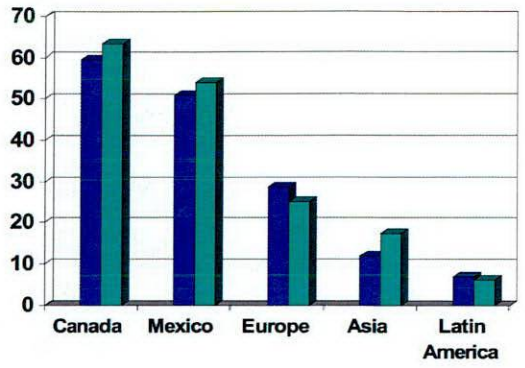
Survey respondents were also asked to categorize their customer base in terms of how far the customers are from the respondent's plant. The results are summarized in Figure 1. A "Local" location was defined as being less than 100 miles from the plant, "Regional" as being 100 to 500 miles from the plant, and "National" as being more than 500 miles from the plant. The submitted data indicates that slightly more than 50% of the sales of US plating firms come from so-called "Local" customers. This is not an unexpected result in light of the increases in travel costs that have occurred in the last few years.

Figure 1. Location of the Majority of Job Shop Customers



These same finishers were also asked to identify the location(s) of their international customers, if any. Figure 2 lists the six geographic regions US Tier V respondents identified as places where they do international business. The first thing to note is that an impressive 45.3% of responders have business relationships with international customers, versus 41.6% four years ago. As would be expected, Canada and Mexico are the leading locations, with both showing an increase of about 3% over 2004. The data also shows about a 5% increase for doing business in Asia, with both Europe and Latin America showing small decreases. This subject has not been researched before, so predicting a trend is not possible. However, it's appropriate to state that U.S. platers are enjoying an increasing volume of international metal finishing business. Perhaps it is due, as some responders have suggested, to the weak US dollar, versus most other foreign currencies. Paying for plating services with a lower cost US dollar makes good economic sense for foreign companies.

Figure 2. Location of Job Shop International Customers 2004 versus 2007



JOB SHOP PROMOTION

The survey also asked the Tier V members a variety of questions related to business promotion methods they use, computer applications they use regularly, how and how often they use the Internet, and how often they visit the standard finishing industry web sites. This section discusses the data that was received from the 134 firms that responded to this portion of the survey.

Methods Used

NASF Tier V members were asked how they promote their services to new and existing customers. Table 50 summarizes the answers submitted for 2007, and also is compared with responses from 2004 and 2000. Note that responses add up to much more than 100%. This is because shops generally use more than one promotional method. The most popular techniques reported this year are the same as they were 3-years ago, namely, word of mouth and the finisher's own web site.

The survey reflected slight decreases in the use of business directories, direct mail, and paying for preferential treatment by search engines on commercial web sites. In general, promotional techniques are relatively the same as four years ago. One exception was that the 2007 data indicated a modest move by job shops to replace sales personnel that represent multiple companies with direct sales personnel that represent only one company.

Table 50. Methods Used by Job Shops to Promote Their Services

Method	2000	2004	2007
Word of Mouth	-	90.3%	81.3%
Shop Website	-	70.1%	79.1%
Yellow Pages	50.4%	51.9%	46.3%
Sales Rep	46.6%	48.1%	44.0%
Direct Salesmen	45.8%	35.7%	39.4%
Business Directories	48.5%	48.1%	33.6%
Exhibit at Shows	25.4%	24.7%	22.4%
Commercial Website	-	19.5%	16.4%
Direct Mail	25.8%	23.4%	14.2%
Magazine Advertising	13.2%	9.7%	9.7%

Metal Finishing Web Sites

Eighty-six companies responded to the portion of the survey that asked about finishers' use of the various metal finishing industry web sites. Table 51 lists the 13 web sites mentioned by survey respondents. The top three sites (www.nasf.org, www.finishing.com, and www.metalfinishing.com) were mentioned almost twice as often as the next most popular web sites.

Table 51. Most Popular Finishing-Related Web Sites

Web Sites	Usage
nasf.org	69.8%
finishing.com	64.0%
metalfinishing.com	64.0%
pfonline.com	36.0%
es.epa.gov	15.1%
nmfrc.org	12.8%
finishingtodaymag.com	9.3%
dol.gov/elaws	5.8%
strategicgoals.org	3.5%
svc.org	2.3%
ncms.org	1.2%
sme.org	1.2%
gardnerweb.com	1.2%

QUALITY CONTROL SYSTEMS

QC Certification/Registration

Job shop respondents were asked if they currently operated with ISO or any other registered management system(s). The follow-up query asked, if not, was there any plans to apply for a registered management system. There were 139 responses to this question, which are listed in Table 52.

Table 52. Quality Levels Currently Held or Anticipated

	Certified/Registered	Applied For	Plan to Apply
QS 9000	3.6%	0.0%	2.2%
AS 9000	4.3%	0.7%	3.6%
ISO 9000	33.8%	2.9%	13.0%
1SO 14000	5.8%	0.0%	8.7%
NADCAP	15.1%	0.0%	9.4%

ISO 9000 is still the most popular choice for a registered management system, with nearly 34% of the responding shops indicating they were presently approved, and with an additional 16% indicating they planned to apply. When this same question was asked for the 1997-1998 report, the levels were considerably lower, but the numbers are comparable to those from the 2004 report.

It's interesting to note that the total number of certifications, applications, and planned applications in 1997-1998 for ISO 9000 closely matched the number of actual certifications in 2004. 37.7% versus 39. This was not true for the other quality levels, which either exceed or fall short of anticipated levels. For 2007, only NADCAP indicated some follow through as the 11% who planned or had applied has turned into an increase to 15% from 11%.

Quality Management Tools

The second question on quality control concerned the incorporation of business or quality management tools. Respondents were asked to check all the methods that applied from a list of a nearly a dozen. A total of 81 responses were received. Table 53 shows the complete results for all methods.

As can be seen, Statistical Process Control (SPC) was still the most popular with 78% of respondents utilizing this tool (versus 71% in 2004). There were 31% who reported using Total Quality Management (TQM), 38% using Lean Manufacturing, and 33% using Just in Time (JIT). All three of these tools were lower in reported use than in 2004.

Table 53. Quality Management Tools Used by Metal Finishers

Tool	2004	2007
Statistical Process Control (SPC)	71%	78%
Total Quality Management (TQM)	45%	31%
Lean Manufacturing	41%	38%
Just in Time (JIT)	39%	33%
Six Sigma	14%	17%
Flow Manufacturing	13%	11%
Kaizen	12%	7%
Enterprise Resource Planning (ERP)	4%	1%
Theory of Constraints (TOC)	5%	3%
Agile Manufacturing	2%	1%
Transaction Processing System (TPS)	2%	1%

JOB SHOP ECONOMIC OUTLOOK

Metal finishers were asked for their estimate on future sales and their change in sales levels from last year. They also asked about their future plans for capital expenditures. In general the outlook for the future is fairly optimistic.

Sales Volume

The estimated sales volumes for different sized NASF job shops are summarized on Table 54. In comparing the results of the 138 respondent's column of 2007 with the past four surveys, it is obvious that the distribution has significantly shifted, upward toward the larger facilities and away from the smaller shops. The columns indicate the percentage of respondents in each category. The average sales volume/shop in 2007 is $5.1 million (compared to $4.7 million in 2004, $4.8 million in 2000 and $3-3.2 million in 1997 -1998) and the median of $2.94 million (compared to $2.65 million in 2004, $2.2 million in 2000, and $1.5 to 1.7 million in 1997 and 1998). Inflation is part of the explanation for this change, but so is the trend away from small shops toward medium-sized ones. The data in Tables 3 and 54 indicate a NASF Tier V job shop revenue/employee of $102,000, which ranged from $75,000 to $89,000 in the past.

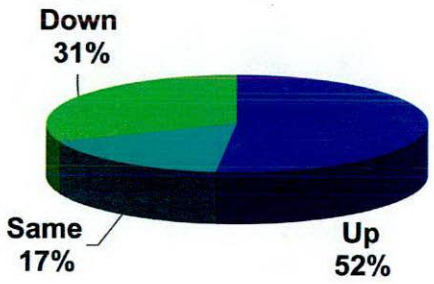
Table 54. NASF Tier V Job Shop Annual Sales Revenue

$ Millions	1997	2000	2004	2007
<0.25	8.70%	10.00%	1.80%	2.20%
0.25-0.5	11.00%	6.20%	4.40%	2.90%
0.5-1	15.60%	13.50%	9.40%	8.00%
2-Jan	22.10%	18.50%	19.60%	19.60%
3-Feb	13.30%	12.40%	21.50%	18.10%
5-Mar	12.90%	11.60%	16.40%	20.30%
7-May	5.30%	6.60%	8.20%	8.00%
10-Jul	5.30%	6.20%	8.20%	8.00%
15-Oct	3.40%	6.90%	6.90%	8.70%
>20	1.20%	5.40%	1.20%	2.90%

Business Trends

A comparison of the 2007 shop sales revenue with 2006 is shown in Figure 3. It shows that of the 139 responders, 52.5% of finishers report sales up at an average of 6.6%. The down response by 30.2% of the responders was an average of 8.4% and 17.3% reported no change. This indicates that 2007 was a slightly better year than 2006 for job shops.

Figure 3. Shop Sales Revenues for 2007 Compared to 2004



The distribution of NASF job shops reporting increases is shown in Figure 4. Slightly more than 30% of the job shops experiencing sales increases reported them to be 10%. The distribution of finishers reporting decreases is shown in Figure 5.

Figure 4. Distribution of 2007 Shop Sales Revenue Increases

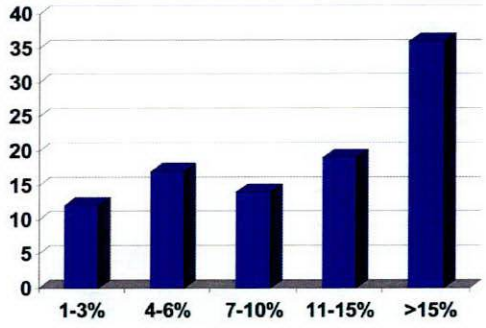
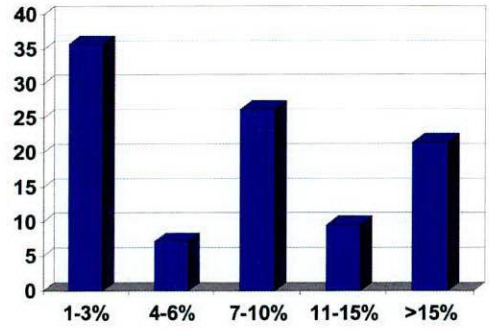


Figure 5. Distribution of 2004 Shop Sales Revenue Decreases



Business Forecasts

More than 60% of the 139 responding finishers forecast an increase in business for 2008 as shown in Figure 6. The responders (138) are even more optimistic for the long term (5 years) with nearly 80% expecting an average of 5.3% increase as shown in Figure 7. In summary, only 9 -12% of finishers forecast near-term and long-term downtrends. Slightly more, 14-26% expect no change.

Figure 6. Anticipated Sales Revenue for 2008 over 2007

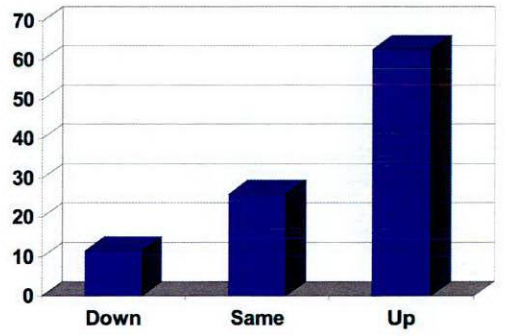
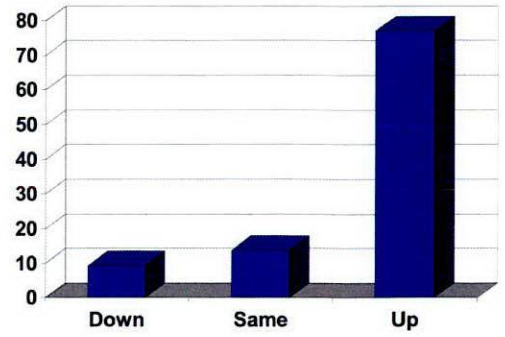


Figure 7. Anticipated Long-Term Shop Sales Revenue



Capital Expenditure Plans

Capital equipment expenditures planned for 2008 are listed in Table 55. The 138 NASF Tier V job shop respondents indicate a decrease of 2.5% in expected expenditures in 2008 with an average of $151,000. The median for 2008 is lower than 2007 at $43,000 vs. $54,600. This data represents a relative consistent degree of capital spending consistency for the near-term future of the finishing business.

Table 55. Anticipated NASF Tier V Job Shop Capital Equipment Expenditures for 2008

$, Thousands	Estimate for 2008
<10	11.6%
10-24.9	22.9%
25-49.9	19.6%
50-99.9	17.4%
100-249.9	13.0%
250-499.9	7.2%
500-1,000	2.9%
>1,000	4.3%

OVERSEAS MARKET FORECAST

Sales Potential

All the chemical suppliers were asked to report their respective estimates of the size of the annual metal finishing proprietary chemical markets for Europe and South America. The survey also requested estimates for the Southeast Asian market, but the data varied too much to be of use in this report. The estimates for Europe and South America are listed below. The SFMRB Committee concurs with these numbers.

Europe - $480 million

South America - $90 million

Business Trends

Ten respondents expect continued, substantial growth (20%-50%) in the Southeast Asian market over the next three years. These same respondents also forecast a moderate growth rate in Europe (flat to 20%). No growth is forecast for South America during this period.

CHALLENGES FACING THE INDUSTRY

Job Shops

Metal finishers were asked to identify the top three challenges to their businesses in the next few years. A dozen items were listed and each respondent was asked to mark the top three by using numerals 1, 2 and 3, with 1 being the greatest challenge to be faced. The responses were weighted by assigning a value of 3 points to the number one challenge, 2 points to the number two challenge and 1 point to the number three challenge, and then totaling the calculated values for all 12 items. Table 56 summarizes the results.

By far the leading challenge the average metal finisher identified is business moving offshore, which scored 140 points. Next was metal price increases (106), followed by five closely bunched challenges: finding qualified labor (78), the cost of employee benefits (74), energy price increases (73), environmental compliance costs (69), and customer pressure to lower prices. The least challenging items were employee training and elimination of various finishes, which was similar to the results of the last survey in 2004.

The 1997-1998 SFMRB report also asked about the greatest challenges finishers faced at that time. The vast majority of finishers identified environmental compliance as the number one challenge, finding qualified labor as number two, and increased costs, domestic competition, and foreign competition rounding out the top five. SFMRB Report No. 7, which addressed the automotive sector in 2001, listed the top five challenges to metal finishing job shops as follows: (1) pressure to lower prices, (2) environmental compliance costs, (3) business moving offshore, (4) improving quality, and (5) elimination of various finishes.

Table 56. Point Rating for Challenges Facing Job Shops

	2004	2007
Businesses Moving Offshore	205	140
Metal Price Increases	43	106
Finding Qualified Labor	42	78
Cost of Employee Benefits	139	74
Energy Price Increases	87	73
Environmental Compliance	137	69
Pressure to Lower Prices	127	67
Changing Worker Safety Rules	94	26
Improving Quality	22	23
Domestic Competition	33	16
Employee Training	12	16
Elimination of Various Finishes	10	9

Chemical Suppliers

The 26 Tier I through Tier IV chemical suppliers were also asked to identify the greatest challenges to their finishing businesses in the coming years. The ranking procedure was slightly different than with the finishers: Only six items were listed, but the suppliers were asked to rank all six, with 1 signifying the item that represented the greatest challenge. An equivalent scoring procedure was used to rank these six challenges from the most serious to the least. Table 57 summarizes the results of the 25 firms that responded.

Eighty percent of the supplier firms mentioned pricing pressure as their greatest challenge. Movement of business offshore to Asia was second. Next in importance was compliance with environmental regulations. The common denominator of these challenges is that they all have a significant negative impact on operating profits.

Table 57. Top Challenges Facing Finishing Industry Suppliers

Challenge	First	Second	Third	Total	Weighted 3,2,1
Pricing Pressure	10	7	3	20	47
Customers Moving to Asia	5	6	4	15	31
Environmental Regs.	4	4	6	14	26
Employee Availability	4	4	4	12	24
Customers Moving to Other Overseas Areas	2	4	5	11	19
Homeland Security	0	0	3	3	3

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