THE RISE TO PROMINENCE OF THE MODERN DIAMOND CUTTING INDUSTRY IN INDIA

By Menahem Sevdermish, Alan R. Miciak, and Alfred A. Levinson

The modern diamond cutting industry in Indiabegan slowly in the late 1950s but did not gain momentum until the mid-1960s. In the 30 years from 1966 to 1996, the industry grew at a remarkable rate: 82-fold by polished weight and 249-fold by polished (wholesale) value. Today, India accounts for about 70% by weight and 35% by (wholesale) value of the diamonds polished annually worldwide (excluding the effects of recent temporary surpluses of Russian rough diamonds in the market), and it has a near-monopoly in smaller (less than 7 pt) stones. Using production, sales, and other statistics, this article reviews the rise of the modern diamond cutting industry in India and its impact on the world diamond trade. India has had a profound effect on this trade because of the enormous quantities of small, low-cost diamonds manufactured there.

ABOUT THE AUTHORS

Mr. Sevdermish, FGA, author of The Dealer's Book of Gems and Diamonds *(1997), is founder and president of The European Gemological Center and College, Ramat Gan, Israel; e-mail, smenahem@netvision.net.il. Dr. Miciak is associate professor of marketing in the Faculty of Management, and Dr. Levinson is professor emeritus in the Department of Geology and Geophysics, University of Calgary, Alberta, Canada.*

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Undoubtedly one of the main dynamics in the world diamond market over the past three decades has been the rise of the diamond cutting industry in India (figure 1). Characteristically, India has focused on cutting and polishing only small (typically 7 pt and less when finished), low-quality "near-gems" for export to jewelry manufacturers around the world.

Initially the "make" (quality of proportions and finish) of Indian polished diamonds was poor, but by about 1970 the quality had improved to the point that competition from this source was being felt in Antwerp and Israel (Goldwasser, 1970). Soon thereafter, almost all the small, low-quality polished diamonds in the world market were cut in India. Attempts by other Asian countries to capture this market (e.g., Sri Lanka, Thailand, China; "Technical training," 1994) have met with only limited success. In 1993, for example, factories in Sri Lanka exported 700,000 carats of small polished diamonds ("Sri Lanka keeps a steady pace," 1995), but this represents only 5% of India's production for that year.

India's importance as a diamond cutting center has not been well documented in the gemological literature. For example, the second edition of Bruton (1978, p. 200) devoted exactly four *words* to the Indian cutting industry: "India also cuts 'smalls'." Yet, in the same year that book was published, India exported 4.32 million carats (Mct) of polished diamonds, which represented 52% of the world's polished supply by weight and 16% by value.

The strengths and characteristics of cutting centers are important to gemologists because of their implications for supply of (and, ultimately, demand for) gems. Thus, the purpose of this article is to trace developments in the important Indian diamond manufacturing industry as they relate to the gemological community. One implication of these develop-

Figure 1. One indication of the growth of the Indian diamond cutting industry is the development of a jewelry manufacturing sector. This bib-style necklace designed by Priya Sewani of India, sponsored by Su-Raj Jewellery India Ltd., was a winning entry in the 1998 Diamonds International Awards Competition (one of four Indian pieces to be so honored). The piece is set with 1,210 diamonds weighing a total of 120.23 ct.

ments is the emergence of a whole new class of "cuttable" diamond, that is, "near-gems": small, low-quality stones that are commercially feasible as gems only because of the availability of good, inexpensive labor such as in India.

BACKGROUND

Diamonds have been mined in India since before the fourth century BC, although mining virtually ceased there about 1750, shortly after the discovery of major deposits in Brazil. The locally mined diamonds were fashioned in India, possibly as early as the late 14th century (Bruton, 1978). However, the modern era of diamond cutting and polishing (henceforth, "cutting") in India has been totally independent of the local mines (Sevdermish and Mashiah, 1996).

Early Developments. In 1909, a fortuitous event laid the organizational foundation for the modern diamond cutting industry in India. In the city of Palanpur (Gujarat State), about 600 km (375 miles) north of Bombay (figure 2), some urban mercantile families (now called Palanpuris) entered the trade as import agents for polished diamonds, largely to supply European dealers operating in India. These individuals were followers of the Jain religion, which emphasizes close family ties and cooperation, maintains strict rules of business conduct, and has a high percentage of arranged marriages within the community. Because of the strength of their community, and their business acumen, the Jains tend to prosper in any business into which they venture (Shor, 1993). By the beginning of World War II, the Jains, among whom Kirtilal M. Mehta, Maftalal Mehta, and S. G. Jhaveri are patriarchs, had established international contacts and buying offices in Antwerp and other diamond centers.

When India became independent in 1947, industrial development took precedence over most other pursuits, so little foreign exchange was available for the importation of polished gems. Therefore, as early as 1949, some Palanpuri entrepreneurs ventured away from strictly import-

Figure 2. India's diamond sector flourishes in the states of Gujarat, Maharashtra, and Goa. Key urban areas where diamond cutting and polishing are major industries are also shown.

ing finished goods and went into manufacturing, establishing a few small factories to polish diamonds for the local market (Chhotalal, 1984). They selected the city of Surat as the initial manufacturing site because of its proximity to Bombay, an international trade center. With time, numerous other cutting centers developed, mostly in the western part of the country and particularly in Gujarat (now the "diamond state" of India; figure 3).

Industry-Government Relations. The industry developed very slowly through the 1950s and early 1960s, primarily because the supply of rough was erratic (the result of foreign currency restrictions and other reasons discussed below) and, perhaps even more significant, because of a strained relationship with the government (Shor, 1993). Notwithstanding the existence of a few small factories, the Indian government frowned on the nascent diamond industry, because importing rough diamonds meant exporting foreign currency ("Small diamonds, big business," 1995); further, diamonds were being used domestically as a hedge against inflation, a practice not in line with government objectives. To overcome this obstacle to importing rough, the Palanpuris devised a solution that would not only eliminate domestic consumption but also create enormous employment opportunities.

They proposed that the diamond companies would import only rough diamonds and manufacture them into polished for export at a mandated percentage of added value. This would create jobs and generate foreign exchange, a dual benefit to the nation. The government accepted this concept (officially known as the "Replenishment Scheme"), and in 1955 it granted the first formal licenses for the import of rough based on the level of polished diamond exports. As logical as the idea was, mistrust continued between the government and the diamond trade. The licensing system was cumbersome and difficult, government corruption was always a problem, and some in the industry were involved in smuggling and in fiscal and licensing irregularities (see Shor, 1993, for details).

Over time, the relationship between the government and the industry improved, as the dual objectives of job creation and increased foreign earnings materialized. Subsequently, the government helped the industry in several ways, for example: (1) with more flexible regulations for the importation of rough; (2) by relaxing foreign currency regulations (i.e., permitting qualified companies to have overseas foreign currency accounts); (3) by eliminating in 1983 the prevailing 5% duty on rough imports; (4) by setting up the Gem & Jewellery Export Promotion Council (GJEPC; see below) and the Hindustani Diamond Company (to help small producers obtain rough); and (5) with tax incentives, particularly exempting export profits from taxation (Scriven, 1997). The success of job creation can be gauged by the fact that in the 1990s as many as 600,000–800,000 workers were employed in diamond cutting, some part-time, both in modern factories and in the cottage industry sector (Sharma, 1992; Jhaveri, 1994; Pandya, 1997).

The Search for Rough. But the Indian cutting industry faced other obstacles. In their earliest years, Indian cutting establishments had great difficulty obtaining rough. Their fortunes were helped by two events.

First, two African countries—Ghana in 1962

and Zaire during most of the period 1973 to 1981—stopped selling their diamonds through the CSO ("Putting the Argyle story. . . ," 1996; Sevdermish and Mashiah, 1996), which made it possible for India to obtain needed rough (albeit, sometimes through illicit channels) from primary sources. Because Ghanaian production (like that of Zaire) was frequently of very poor quality, some dealers and cutters such as Jasani (1971, p. 25), were led to bemoan that "the rough diamonds that are imported are mostly industrial and industrial sand. . ." and that "We fail to understand as to how industrial diamonds could be cleared [as] gem variety [sic]." These industrials would, in time, gain a modicum of respectability as near-gems.

Second, in 1964, the first indigenous Indian sightholder was appointed ("Diamond trading over fifty years," 1984), which attested to recognition by De Beers of India's growing diamond industry (although the first Indian sightholder, based in Antwerp, was appointed in 1959). By 1970 this number had risen to 12, and in recent years there have been about 45 indigenous Indian sightholders ("India expands on all fronts," 1989; "Recovery waiting in the wings," 1994) out of about 160–170 sightholders worldwide (Miller, 1995; "Five new sightholders appointed," 1997). During the period 1965–1984, most of the low-value stones purchased from De Beers probably originated from De Beers mines in South Africa (e.g., Premier and Finsch), from the Soviet Union (the vast majority of which were marketed through De Beers at that time), and later from Botswana (Orapa, with a high proportion of near-gems, opened officially in 1972 with production of 2.5 Mct [million carats] annually; Jwaneng started production in 1982 with 5 Mct annually). As this period ended, India was receiving about 25–30 Mct of rough annually (table 1, column 2).

From 1973 to 1988, the amount of rough supplied directly by De Beers varied from approximately 25% to 50% of India's annual rough imports; however, De Beers typically supplied an additional 15% to 20% indirectly through Antwerp sightholders who received rough solely for India (Chhotalal, 1984; "India expands on all fronts," 1989).

Perhaps the single greatest influence on the Indian cutting industry was the 1979 discovery of the Argyle mine in Western Australia. The mining of alluvials associated with this mine started in 1983, and 6.2 Mct were recovered that year. Mining of the Argyle (lamproite AK1) pipe proper started in December 1985, and ushered in the greatest expansion in the annual production of rough diamonds the world has ever seen. Nevertheless, the vast majority of the stones from Argyle are small, low-quality near-gems that can only be cut economically in India (or some other low-wage country). Concurrently, on the demand side, there was a great expansion of retailing formats in mass merchandising throughout the world, but primarily in the United States, that has provided a broad market outlet for inexpensive, mass-produced diamond jewelry (Boyajian, 1988; Shor, 1993). Thus, the favorable dual factors of supply and demand were instrumental in stimulating the explosive growth of the Indian diamond cutting industry.

Figure 3. Gujarat State grew quickly into a diamond "boom town" during the 1970s and 1980s, and informal street markets where traders bought and sold rough and polished diamonds proliferated around the city. This market on Rampura Road was the city's largest. Photo by Russell Shor.

From figure 4 (see also table 1, column 2), it can be seen that with the growth of mining at Argyle, the import of rough into India approximately doubled from 1984 (about 26 Mct) to 1991 (about 55

TABLE 1. Diamond cutting production in India from 1966 to 1996, on a weight basis.[a]

1[b] Year	2[e] Imports of rough diamonds into India (Mct)	3[e] Exports of polished diamonds from India (Mct)	4[f] Yield for diamonds cut in India (%)	5[g] Total world polished production, or amount sold at wholesale (Mct)	6[h] Percentage of the world's diamonds polished in India
1966	*1.35*	*0.23*	(17)	*3.9*	6
1967	*1.70*	*0.29*	(17)	*4.1*	7
1968	*3.24*	*0.55*	(17)	*4.2*	13
1969	*2.82*	*0.48*	(17)	*4.6*	10
1970	3.08	0.53	17.2	*4.8*	11
1971	3.94	0.66	16.8	*4.8*	14
1972	4.36	0.80	18.3	*5.1*	16
1973	5.96	1.69	28.4	*6.0*	28
1974	3.71	1.07	28.8	*5.5*	19
1975	5.57	1.00	18.0	*5.1*	20
1976	8.82	1.92	21.8	*5.8*	33
1977	16.89	3.10	18.4	*7.0*	44
1978	19.33	4.32	22.3	*8.3*	52
1979	15.80	4.46	28.2	**7.9**	56
1980	18.71	4.15	22.2	**7.5**	55
1981[c]	26.36	4.06	15.4	**7.8**	52
1982[c]	25.40	4.66	18.3	**7.9**	59
1983[c]	28.38	5.65	19.9	**8.5**	66
1984[c]	26.28	5.07	19.3	**9.2**	55
1985	34.64	5.41	15.6	**9.9**	55
1986	39.92	7.52	18.8	**11.4**	66
1987	46.52	8.49	18.3	**13.2**	64
1988	54.06	11.03	20.4	**14.5**	76
1989	59.70	10.11	16.9	**14.7**	69
1990	37.13	8.34	22.5	14.2	59
1991	54.59	8.72	16.0	**13.6**	64
1992[d]	72.29	11.03	15.3	**15.0**	74
1993[d]	69.61	13.99	20.1	16.6	84
1994[d]	69.17	15.98	23.1	18.2	88
1995[d]	89.90	19.21	21.4	**19.7**	98
1996[d]	101.28	18.88	18.6	**20.5**	92

[a] *Numbers in italics are calculated, in parentheses are estimated, underlined are extrapolated, and (in column 5) in bold are actual reported values. Mct = millions of carats.*

[b] *The Indian financial year runs from April through March. Hence, Indian annual diamond statistics that appear, for example, as 1970/71 or 1989/1990 (e.g., Chhotalal, 1984, table 3) are shortened here to 1970 and 1989, respectively. However, because no other data for the diamond industry in the rest of the world are reported in this manner, the "years" in this paper are not exactly comparable with others worldwide.*

[c] *The period 1981–1984 was characterized by a decrease in De Beers's sales, "destocking," and an increase in demand for small diamonds cut in India (see, e.g., Boyajian, 1988).*

[d] *The period 1992–1996 was characterized by imports of large amounts of Russian near-gem rough, and stockpiling of some exported but unsold polished goods.*

[e] *Sources of information for columns 2 and 3:*

- *1966–1969: Column 2 is calculated (column 3 ÷ column 4) x 100.*
- *Column 3 is calculated from financial data (value of exports in rupees) in* Directory of Exporters 1983 *(1984), and based on the number of carats (0.53 million) and their value exported from India in 1970 (Chhotalal, 1984). Allowance has been made for the rupee being worth 16% more in 1966 than in 1967–1970 (as reported in "International financial statistics," 1988).*
- *1970–1979: Chhotalal (1984, table 1)*
- *1980–1994: "India's rude awakening" (1996)*
- *1995–1996: "Gems & jewellery exports record-downtrend in 1996–97" (1997)*

[f] *Obtained by the formula:*

(column 3 ÷ column 2) x 100

The yield for 1966–1969 was estimated at 17%, comparable to values obtained for 1970–71.

[g] *For 1966–1978, calculated values were obtained with the following formula:*

Total world polished production = world production of rough [carats] x 0.25 [% gems] x 0.40 [estimated average yield] + Indian polished exports.

Annual world production of rough diamonds was obtained from U.S. Bureau of Mines (1966–1978). The formula is used only for years prior to 1979, when there was no "Argyle factor," i.e., large amounts of near-gems and industrials, to consider. The fact that before 1979 about 25% of the world's diamonds were gems and thus cuttable (i.e., the "0.25" factor), and the average yield from such rough was about 40% (the "0.40" factor), can be found in Levinson et al., (1992) and in Diamonds: A Cartel and Its Future, *(1992), respectively. The polished production originating from India is obtained from near-gem rough with low average yield (averaging 20%; see column 4) and is not covered in the first part of the equation. Hence, the amount of Indian polished (from column 3) is added to that obtained by calculations from the traditional gem material to obtain the world total.*

For 1979–1996, boldface values reflect the number of carats sold at wholesale for manufacture into jewelry (excluding stockpiled goods), for which there are data for most years since 1979. Thus, we are assuming that the amount of diamonds polished worldwide was approximately equal to the amount sold.

References:

1979: Johnson et al. (1989, table 7)
1980–1987: "Value of diamond jewelry sold..." (1988)
1988–1989: "World diamond jewellery consumption" (1991, table 6)
1991: De Beers *(1992, p. 33)*
1992: Even-Zohar (1993, p. 78)
1995: "World diamond jewelry sales" (1996)
1996: "1996: Diamond content equals record 1995" (1997)

[h] *Obtained by the formula:*

(column 3 ÷ column 5) x 100

Mct). About 30 Mct of Argyle's annual production of 40 Mct apparently went to India (e.g., "India's rude awakening," 1996). Through June 1996, most Argyle diamonds were marketed by De Beers. Now all of these stones are marketed independently through Argyle's office in Antwerp, but most continue to be cut in India.

The Indian Industry. As the Indian diamond industry expanded, so did the influence of the Palanpuris. As the major indigenous sightholders, they supply most of the rough to the cutting factories, many of which they own. Further, they enjoy a near-monopoly in the international sale of polished stones by virtue of their control of a sprawling sales network for polished diamonds, which Lakhi (1997) estimates exceeds 1,000 offices worldwide. In recent years, there has been considerable vertical integration of the diamond industry, which now includes jewelry manufacturing (figure 5). Most of this also is dominated by the Palanpuris. Since the early 1990s, however, a new entrepreneurial class of diamantaires, who learned the diamond business mainly as employees of the Palanpuris, has emerged: the Kathiawaris. Their name is derived from Kathiawar, an agricultural region also in Gujarat, but they differ significantly from the Palanpuris with whom they now compete. Not only are they of rural origin and modest financial means, but they also are Hindus. At least four have become sightholders (Lakhi, 1997).

Notwithstanding the aforesaid, it was the economic viability of cutting low-quality, low-yield rough with low-cost labor by skillful and industrious artisans that formed the basis for the modern diamond cutting industry in India (figure 6). Stuyck (1969, p. 20) described the cutting industry in the early days as "almost exclusively a cottage industry. From five to ten persons work together in their own cottages. They have had no formal training. They learn by doing." These workers were not covered by general labor legislation and were paid on a piece-rate basis. Even recently labor costs have been described as "infinitesimal" ("Small diamonds, big business," 1995, p. 38) or one-sixth ("Maintaining its global position," 1994, p. 68) compared to those of the cutting centers of Belgium and Israel. Interestingly, the cost of polishing small stones in India has not changed much over the last two decades in terms of dollar amount, averaging about $1 each (Lawrence, 1996). This is largely because the rupee has been depreciating against the dollar at an annual rate of about 10%, which has been enough to counterbalance the local rate of inflation.

Figure 4. This graph plots, in millions of carats, the amount of rough diamonds imported into—and polished diamonds exported from—India from 1966 through 1996. It is based on data in columns 2 and 3 of table 1. (Note: The slope of the polished exports curve is dependent on the cutting yield, which was generally 15%–23% of the weight of the rough; hence, although both curves in this figure represent increasing quantities, they are not parallel on an arithmetic scale.)

Over the decades, however, there has also been a shift toward the formal training of diamond cutters ("Technical training," 1994) and the establishment of large, automated factories to keep pace with the vast amounts of rough coming into the country (figure 7). This has resulted in a rise in productivity and yield levels, as well as in improved "make"; automation has also had an offsetting effect on rising labor costs. Nevertheless, the cottage-industry sector still flourishes, as evidenced by the fact that there are "an estimated 30,000 small, medium, and large diamond cutting and polishing units" ("India's rude awakening," 1996, p. 92), but only about 5,500 of these are large enough to be called companies (Scriven, 1997). Further, about 50% of India's workforce is made up of "contract workers" (Lawrence, 1996), who generally do not work in modern factories. Attesting to the skill of the experienced Indian worker is the fact that full automation, relative to the good artisan workforce,

Figure 5. In recent years, India has developed a significant jewelry manufacturing industry for the small, inexpensive diamonds cut there. These typical pieces, from Simplex Diam Inc., were developed specifically for the large chains and mass merchandisers that have dominated the American market in the 1980s and 1990s. Courtesy of the Indo Argyle Diamond Council.

would probably boost yield only by one or two percentage points (Lawrence, 1996).

After about 1966, the Indian cutting industry grew rapidly but approximately in step with the rest of the world diamond industry, except for two periods: 1981–1984, when it was stronger than the rest of the industry; and 1992–1996, when it was weaker.

1981–1984. For the four years following the 1980 collapse of the speculative boom in diamonds, De Beers's sales averaged only about 55% of what they had been in 1980. Yet the total value of world retail diamond sales (as measured in billions of U.S. dollars) was unaffected (discussed below). This phenomenon is explained by "destocking" (i.e., retailers sold from stock but were not restocking to the same levels, so suppliers were not selling and thus were not buying from the major polishing centers; Boyajian, 1988). Although some retailers (such as some traditional stores) suffered losses, others (specifically the discount stores and mass merchandisers in the United States, whose business was primarily based on low-cost Indian-cut stones) even thrived. During these turbulent times, there was actually a dramatic increase in demand for jewelry containing inexpensive diamonds produced in India.

1992–1996. Since 1992, the rough near-gem market has been destabilized (as have other categories of diamonds to a lesser extent; Pearson, 1996b) by the "dumping" of diamonds from Russia. Following the breakup of the former Soviet Union, the new nation of Russia needed foreign currency. One source of such revenue were the diamond stockpiles (rather than new mine production) that had been built up over more than three decades ("Flooding the diamond markets," 1993; Shor, 1994). In 1992, Russia began to "leak" large quantities of these diamonds outside established channels, a practice that continues today. The arrival (often referred to as "dumping") of these millions of carats of Russian rough diamonds on the world markets outside the contractual arrangements between De Beers and Russia soon weakened the price of polished Indian goods. It also constituted a serious challenge to De Beers's regulation of the rough diamond market (e.g., "Leakages hit CSO market share," 1996).

Pearson (1996b) reported that Russian stockpile reductions of "technical goods" (which includes near-gems) increased in 1995. Estimates are that Russian stockpile reductions (all categories) were 18.5 Mct and 12.3 Mct in 1995 and 1996, respectively; in both years new mine production worldwide was about 111 Mct ("A year of overfeed," 1996; "Supply set to be outstripped . . .," 1997). We believe that the vast amounts of rough diamonds available since 1992 have had a greater impact on the Indian segment of the diamond industry than on the rest of the gem cutting industry, although we do not know exactly how much of this Russian rough was near-gem destined for India. From the data in table 1 (column 2), however, it appears that since 1992 no more than 60 Mct (after subtracting Russian leakage) of rough imports annually could have been obtained by India through normal channels, that is, from the CSO either directly or indirectly, or through normal "outside (non-CSO) sources" in Antwerp. Amounts in excess of 60 Mct are assumed to have come from various other outside (open market) sources, but primarily from Russia. Today, about 30% of India's rough is supplied directly by De Beers (to indigenous Indian sightholders), about 30% is from sightholders in

Antwerp and Israel, and the remainder is obtained on the open market (Mehta, 1997).

INDIAN DIAMOND CUTTING PRODUCTION

The development of the Indian diamond cutting industry from 1966 through 1996 (the most recent year for which data are available), and the critical role it has played in the world diamond trade, can be traced by looking at the statistics for production by weight (table 1) and by value (table 2) during these three decades. These data form the basis for the balance of the discussion in this article.

Sources of Data. The data for this article were taken from the published literature. Where data for certain years are not available, we resorted to estimation by means of extrapolation or calculation. All such cases are clearly identified in the tables.

Data found in different published sources often contradict one another. Moreover, occasionally it has been claimed that certain data, frequently from official sources, are in error. A case in point is the statement that official Indian export figures (dollar value) for 1988–1989 are significantly underreported and, as a consequence, that author has supplied the "real figures" ("India expands on all fronts," 1989). Similar statements have been made with respect to the official Indian rough import and polished export figures for 1993 (Miller, 1995). Notwithstanding the good intentions of the authors of such information, and even the strong possibility that they are correct, for consistency we always use the official figures. Wherever possible, the data (e.g., amount of imported rough, polished production, and sales statistics) presented in tables 1 and 2 come from the Gem & Jewellery Export Promotion Council (GJEPC), a nonprofit, autonomous organization of diamond merchants established in 1966 and operated under the supervision of the Ministry of Commerce of India. These data were usually not available to us directly from GJEPC, but rather we obtained them from secondary sources, which we reference. We consider these data on the Indian gem industry to be the best available. We also consider data in certain journals (e.g., *Diamond International, Mazal U'Bracha)* to be highly reliable and use these where appropriate. However, we are aware that errors of 10%–15% are a distinct possibility for reasons that we discuss at various places within the text.

Production by Weight (Table 1). *Imports of Rough Diamonds into India.* There was a dramatic 75-fold increase (by weight) in the import of rough diamonds into India from 1966 to 1996, as is evident in column 2 of table 1 and is shown graphically in figure 4. (We have assumed, as have others who have written on this aspect of the Indian diamond industry [see, e.g., Sharma, 1991, 1992; Jhaveri, 1994; "India's rude awakening," 1996; Lakhi, 1997], that all the imported rough was cuttable (predominantly near-gems) although it is likely that the yield from some of this material is extremely low and that a

Figure 6. In 1985, workers at this bruting contractor shop in Surat still used manual equipment and sat on the floor. Photo by Russell Shor.

Figure 7. Shrenuj Co. was one of the first companies to develop a modern, semi-automated diamond factory in Bombay in 1988. Photo courtesy of Shrenuj Co.

small percentage of industrial stones is included in the import figures.) The increase is characterized by quantum jumps in imports at certain times, and one interval with a significant decline.

- **1976–1977 (91% increase).** Rough imports almost doubled during the speculative boom of 1976–1979 (see Boyajian, 1988). Although this boom primarily involved "investment" and "certificate" goods because of high inflation worldwide, demand also increased for lower-priced diamonds.
- **1980–1981 (41% increase).** After the end of the speculative boom, demand for less-expensive diamonds increased relative to that for more expensive grades.
- **1984–1989 (127% increase).** During this period, the world market grew rapidly for all kinds of polished diamonds, including the cheaper goods from India (particularly because of the expanding Japanese market, caused by the strong yen; Boyajian, 1988). India responded by sharply increasing its cutting capacity, which peaked in 1989. To feed this greater capacity, Indian manufacturers increased the amount of rough imported, more than doubling it between 1984 and 1989, to about 60 Mct.
- **1989–1990 (38% decrease).** Starting in 1989, the demand for Indian polished diamonds began to decline, and by 1990 imports of rough fell to about 37 Mct, that is, to about the level of 1986. The main reason given for this decline was an economic downturn ("World market trends," 1991). This downturn affected the low-value Indian goods more than it did the better-quality goods, which is opposite to what had occurred during the downturn of 1981–1984 discussed in the "Background" section. World retail diamond jewelry sales, as measured in U.S. dollars, were stable during the period under discussion (see below).
- **1991–1992 (32% increase).** Notwithstanding the difficulties encountered by the Indian polishing industry in 1989–1990 (plus a major financial and political crisis in India in 1991 that temporarily restricted foreign exchange transactions; "Diamonds today. Part 2," 1992), vast amounts of low-quality rough began to be imported from Russia.
- **1994–1996 (46% increase).** The dramatic increase in the import of rough can again be attributed primarily to Russia's sale of vast amounts from its stockpile (Pearson, 1996b). The magnitude of the 101 Mct of rough imported into India in 1996 is put into perspective when it is recognized that the world's total production of newly mined diamonds for that year was about 111 Mct ("Supply set to be outstripped . . .", 1997). As a result of the overstock situation, the Indian diamond community debated imposing a moratorium on the import of rough, but none was enacted ("Indians debate import moratorium," 1996).

Exports of Polished Diamonds from India. Imported rough is polished and then exported to jewelry manufacturers as rapidly as feasible. Indian export normally lags behind import only for the time needed to cut and polish the goods (about three months, or an additional one to two months if the rough is handled by a dealer who is not a sightholder, rather than by a sightholder who is a cutter (*Diamonds: A Cartel and Its Future*, 1992). Hence, the amount of polished diamonds exported from India (table 1, column 3; figure 4) approximately follows the amount of rough imported.

The world economy, particularly as it is affected by the U.S. and Japan, is the main determining factor in how rapidly newly polished diamonds are sold. Thus, since the economic downturn (except for the U.S. and a few other countries) that started in 1989, India generally has been cutting more diamonds than could be consumed in the marketplace. Since 1993 especially, significant amounts of Indian polished diamonds have been exported and then stockpiled abroad at foreign sales offices or with affiliates and/or major dealers so that inventory would be closer to the eventual end user (Lakhi, 1997). Nevertheless, from 1966 to 1996, the 82-fold increase in polished exports from India is qualitatively consistent with the 75-fold increase in rough imports during the same period (table 1).

Yield for Diamonds Cut in India. The yields (weight retained after cutting, expressed as a percentage of the rough weight; also called retention) for the polished exports are presented in column 4 of table 1 and are evident in figure 4 by the gap between the rough and polished quantities; again this assumes that all rough imported into India was cuttable. Yields range from 15.3% to 23.1% (average, 18.7%). (Excluded are 1973, 1974, and 1979, for which the values are over 28%. These high values are explained by the large amounts of stones that

were unofficially imported from Zaire and thus were not recorded in import data but were reported in polished exports; see "Background" for further details.) Similar yields have been reported by others for near-gems; for example, Johnson et al. (1989) reported weight loss as ranging from 75% to 85% (yield 15%–25%).

Total World Polished Production (or Amount Sold at Wholesale). To place the contribution of India in perspective with respect to polished diamond production worldwide, it is necessary to know the total amount of polished produced in the world annually. Unfortunately, such data are not available in the literature, so we have estimated them using two methods. First, total world production of polished can be equated to the amount (number of carats) of polished diamonds sold at wholesale, for which there are data for most years since 1979. This is based on the assumption that, as a generalization, most diamonds are sold at wholesale in the year they are polished; exceptions exist for certain years (particularly since 1993) when there were oversupplies of polished, but these will not materially affect our conclusions. Second, it is possible to calculate the approximate amount of diamonds polished in any year—the formula and explanation for which are given in the table 1 footnotes. Similar formulas have been used in the past (e.g., Komkommer, 1965). We used this approach for 1966–1978. Our estimates are presented in column 5 of table 1.

Percentage of the World's Diamonds that Are Polished in India. The amount of diamonds polished in India (table 1, column 6; figure 8) probably was only 6% of the world's supply in 1966. In slightly more than a decade (by 1978), India had experienced a nine-fold increase, to more than 50% of the world's supply (on a weight basis). This percentage has continued to rise, but at a much slower rate. By 1989, at the peak of the period 1984–1989 (mentioned above) during which the world diamond market grew rapidly, we estimate that India was polishing 69% of the world's diamonds. This was due to strong demand and further downtrading (i.e., more use of less-expensive diamonds) in the U.S. and Japan, which made it possible for the Indian industry to use the lower grades and smaller sizes of Argyle rough that became available in this period.

Since the late 1980s, there has been a common perception throughout the diamond industry that India has supplied about 70% of the world's polished diamonds by weight (e.g., Sharma, 1992; "India's rude awakening," 1996). During 1992–1996, our calculations suggest that India produced 74%–98% of the world's supply of polished diamonds (table 1, column 6). We believe that the incremental percentages above 70% are aberrations. They probably result from the export and storage abroad of polished near-gems, comparable to amounts "dumped" by the Russians during this period, for which there was no immediate sale. Such large percentages will not be sustainable into the significant future because of the expected depletion of the Russian stockpile in a few years.

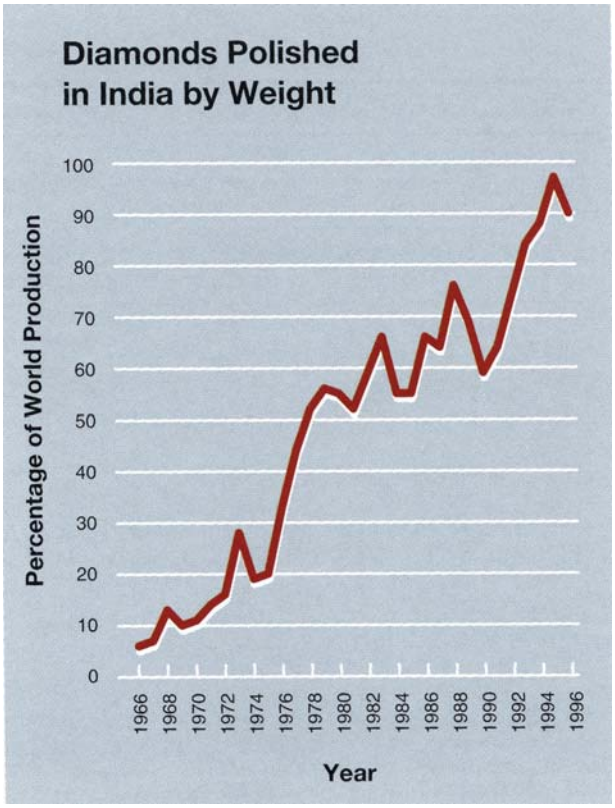


Figure 8. For 20 years now, India has been responsible for polishing more than 50% (by weight) of the world's supply of polished diamonds. Although the calculations on which this graph is based suggest that this percentage might have risen to as high as 98% in recent years, the authors believe that these are aberrations and that 70% is more realistic overall. Data are shown in table 1, column 6.

Production by Value (Table 2). *Value of World Polished Diamond Sales.* To determine the value of the diamonds polished in India since 1966 in comparison with the rest of the world, we first compiled the total annual polished wholesale value of diamonds worldwide for the period 1966–1996 (table 2, column 2). Because published data were only avail-

TABLE 2. Diamond cutting production in India and global jewelry statistics from 1966–1996, on a value basis.[a]

1[b] Year	2[e] Value of world polished diamond sales (wholesale, millions of US$)	3[f] Export value of polished diamonds from India (wholesale, millions of US$)	4[g] India's share of the world polished diamonds (wholesale, % of the diamond market)	5[h] Value of India's polished exports on a per-carat basis (wholesale, US$ per carat)	6[i] World retail diamond jewelry sales (billions of US$)	7[j] Value of diamond content in world jewelry (% of retail sales)
1966	*872*	17	1.9	74	n.a.	-
1967	*859*	21	2.4	72	n.a.	-
1968	*1,048*	40	3.8	73	n.a.	-
1969	*1,208*	34	2.8	71	n.a.	-
1970	*926*	37	4.0	70	n.a.	-
1971	*1,094*	50	4.6	76	4.5	24
1972	*1,486*	78	5.2	98	5.4	28
1973	*2,314*	101	4.4	60	6.9	34
1974	*2,195*	106	4.8	99	7.2	30
1975	*1,866*	118	6.3	118	8.7	21
1976	*2,721*	258	9.5	134	8.7	31
1977	*3,628*	498	13.7	161	10.8	34
1978	*5,104*	846	16.6	196	13.8	37
1979	*5,196*	677	13.0	152	16.1	32
1980	*5,446*	703	12.9	169	20.7	26
1981[c]	*2,760*	797	28.9	196	20.3	14
1982[c]	*2,357*	945	40.1	203	19.1	12
1983[c]	*2,998*	1,109	37.0	196	20.8	14
1984[c]	*3,024*	1,002	33.1	198	22.3	14
1985	*3,418*	1,065	31.2	197	23.6	14
1986	*4,794*	1,511	31.5	201	31.1	15
1987	*5,766*	1,877	32.6	221	37.7	15
1988	*7,823*	2,904	37.1	263	44.0	18
1989	7,700	2,986	38.8	295	45.7	17
1990	*7,813*	2,641	33.8	317	45.4	17
1991	7,609	2,500	32.9	287	46.5	16
1992[d]	*6,663*	2,867	43.0	260	47.0	14
1993[d]	*8,710*	3,657	42.0	261	48.3	18
1994[d]	10,600	4,032	38.0	252	50.1	21
1995[d]	10,800	4,662	43.2	243	52.7	20
1996[d]	11,000	4,235	38.5	224	51.5	21

[a] *Numbers in italics are calculated; n.a. = not available; - = not calculated.*

[b] *See footnote b in table 1.*

[c] *See footnote c in table 1.*

[d] *See footnote d in table 1.*

[e] *Published data for this column are available for the following years:*
1989: "World market trends" (1991, p. 10)
1991: De Beers *(1992, p. 33)*
1994: "Leakages hit CSO market share" (1996, p. 22)
1995: Schnitzer (1996, p. 59)
1996: Even-Zohar (1997, p. 40)
For other years, it was necessary to calculate an approximate value using the formula:

Value of world polished diamond sales = De Beers's annual sales x CF1 x CF2

The first conversion factor (CF1) normalizes the value of De Beers's annual sales of rough to the value of all rough diamonds produced in the world. For 1966–1991, CF1 = 1.25, based on De Beers's traditional 80% control of the rough diamond market: 1 ÷ 0.80 = 1.25. For 1990–1996, CF1 gradually changes from 1.30–1.50 to account for De Beers's decreasing control of the rough diamond market, to about 70% in mid-1996 (Pearson, 1996a) and even less since July, 1996, when the production from the Argyle mine was marketed independently of De Beers.

The second conversion factor (CF2), also a multiple of De Beers's annual sales, takes into account: (a) cutting costs (generally 5% to 20% of the cost of rough); and (b) other costs (including profit, handling charges, etc.) which we estimate at about 25% of cost of the rough. For 1966–1986, when more expensive rough was cut on average, CF2 = 1.4 (1.10 [cutting costs] x 1.25 [other costs] = 1.375). However, in the speculative period of 1978–1980, when profits (of 10–30%) were made on rough before it was cut, the CF2 rises to 1.6. From 1987 onwards when the amount of near-gems cut in India increased greatly, CF2 is 1.5 (1.20 [cutting costs] x 1.25 [other costs] = 1.50). The relative cost of cutting lower quality (near-gem) diamonds is more than it is for cutting better quality goods.

Calculations using conversion factors similar to those above have been used in the past (e.g., Komkommer, 1965). Further information is available upon request to the authors.

[f] *References:*
1966–1969: Directory of Exporters, 1983 *(1984)*
1970–1979: Chhotalal (1984)
1980–1995: "India's rude awakening" (1996)
1996: "Gems & jewellery exports record downtrend in 1996–97" (1997)
Note: For 1966–1969 and 1970–1979, conversion of rupees to US$ was made using conversion rates from "International financial statistics" (1988).

[g] *Obtained by the formula:*
(column 3 ÷ column 2) x 100

[h] *Obtained by the formula:*
column 3 ÷ column 3 in table 1

[i] *References:*
1971–1978: Diamonds: Past, Present & Future *(1992, p.16)*
1979: Johnson et al. (1989)
1980–1995: "Japan holds the key" (1997, p. 42). Note: These data are higher than those reported in the past, and represent new revised figures, although this is not specifically stated. "About 10–12 per cent of the American diamond jewellery market [in smaller stones] at polished wholesale value was not accounted for under De Beers's traditional research methods" ("Marketing to the masses," 1996, p. 3).
1996: "1996: Diamond content equals record 1995" (1997).

[j] *Obtained by the formula:*
(column 2 ÷ column 6) x 100

able for five years (1989, 1991, and 1994–1996), we had to calculate most of this information. Details of how these values were calculated are presented in the footnotes to table 2.

Export Value of Polished Diamonds from India. The value of Indian polished production was negligible before the mid-1960s. In the 24-year period 1966 through 1989, the value of polished exports rose steadily from $17 million to $2,986 million—a 175-fold increase (table 2, column 3; figure 9). Even during the post-speculative-boom period of 1981–1984, when diamond sales worldwide declined, there was no downturn in demand for the small diamonds cut in India. In fact, the export of polished diamonds increased from $797 million in 1981 to $1,002 million in 1984 (table 2, column 3).

The decline in the export of polished diamonds by weight during 1990–1991 from the period immediately preceding is reflected in a similar decline in the total value of polished exports, from $2,986 million in 1989 to $2,500 million in 1991 (table 2, column 3). Following the low of 1991, however, the value of polished exports rose rapidly, and by 1995 they were up 86%. Again, this is due primarily to the export of large amounts of polished Russian near-gems, some of which were not sold but were stored as inventory abroad. It is interesting to observe that between 1995 and 1996 exports dropped, but they dropped much more in terms of value (9%) than of weight (1.7%; see table 1, column 3), which attests to the perils of oversupply. Nevertheless, between 1966 and 1996, the total value of polished diamonds exported annually from India increased 249-fold overall.

India's Share of the World's Polished Diamonds. India accounted for only 1.9% by value of the world's (wholesale) polished production in 1966 (table 2, column 4; figure 10). In general, this percentage increased gradually (at an average of about 1.5% per year) until 1989, when it reached 38.8%. During the speculative era of 1979–1980, the percentage declined slightly, primarily because the price of larger, higher-quality gem diamonds had risen considerably (see Boyajian, 1988). The major jump from about 29% in 1981 to 40% in 1982 can be attributed to the fact that sales of more traditional gem diamonds declined significantly following the speculative period.

Since the late 1980s (1988–1996), India's contribution to the world polished diamond market by

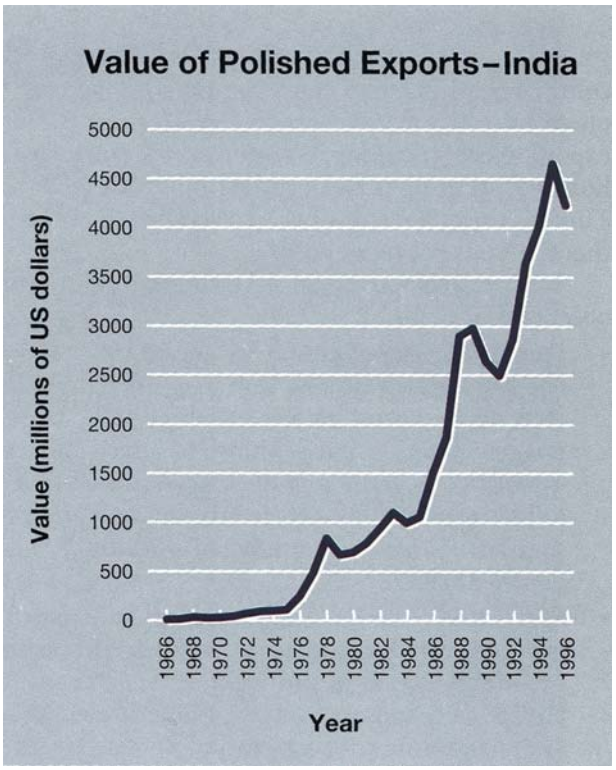


Figure 9. During most of the period 1966–1996, the value of India's polished exports increased steadily, 249-fold overall. The plot is based on data in table 2, column 3.

dollar value (table 2, column 4) has averaged 38.6%. This is lower than some industry estimates of around 40% (e.g., "Technical training," 1994) but higher than the most recent estimate of 30% (Scriven, 1997). Necessarily, this value will vary over time depending on the relative value of diamonds cut in India as compared to those cut elsewhere, as well as on the relative amounts of each type sold at the wholesale level. Values above 40% (table 2, column 4) for the years 1992, 1993, and 1995 (the highest being 43.2% for 1995) are explained by the fact that large quantities of rough originating in Russia were polished in India and exported. (As indicated earlier, not all were necessarily sold, especially since 1993, when many were stockpiled [inventoried] abroad.) When these excesses are excluded, we suggest that India cut about 35% of the world's diamonds on a value basis in 1996 (and the trend is downward).

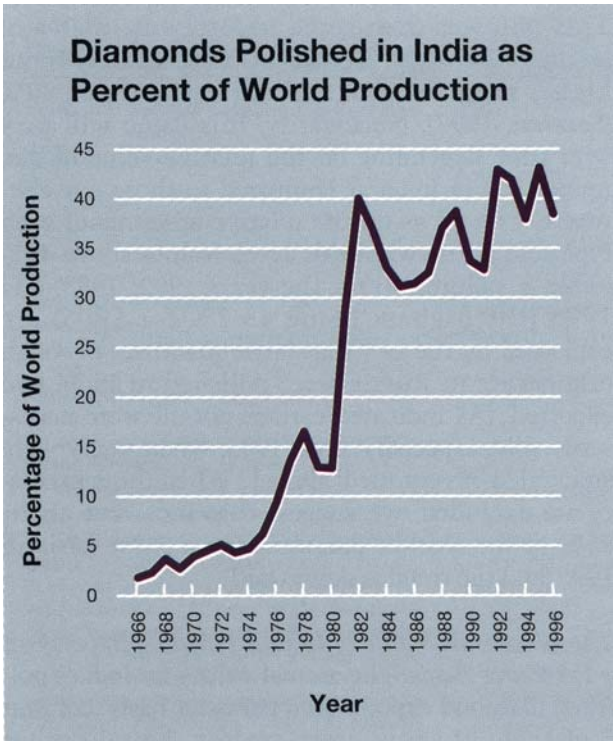
The Wholesale Value of India's Polished Exports on a Per-Carat Basis. The annual values for India's polished diamond exports on a per-carat basis (column 5 of table 2) show more scatter than do other

columns in this table. However, they do indicate a clear overall increase up to 1990 (when Indian exports were valued at $317 per carat). Since then, however, there has been a decline totaling 29%. This is clearly a result of the excess polished goods that the market cannot absorb.

Noteworthy in these data are the following observations:

- During the postspeculative era of 1981–1984, the per-carat value of Indian polished goods showed an overall increase relative to the previous few years, whereas values of larger, higher-quality gem diamonds decreased (much more dramatic was the decrease in value of investment-size, investment-grade diamonds; see Boyajian, 1988).
- Since 1990, the per-carat value of Indian polished exports has decreased, whereas the value of larger gem diamonds has increased ("Antwerp Diamond Index," 1997), a reversal of the situation that prevailed in the period 1981–1984.

Figure 10. For most of the last three decades, India's overall contribution to the world's supply of polished diamonds has risen in terms of value. However, in recent years there have been erratic fluctuations; based on data in table 2, column 4.



Although both trends have some basis in world economics for the particular time periods, the decline in the per-carat value of Indian goods since 1993 has been exacerbated by the glut of polished resulting from the huge amounts of rough imported from Russia.

Indian Component of World Diamond Jewelry Sales. *World Retail Diamond Jewelry Sales.* World retail diamond jewelry sales (i.e., what the consumer paid; column 6 of table 2 and figure 11) were compiled primarily to enable us to illustrate the important effect small, low-valued diamonds polished in India have had on the average value of the diamond content in world jewelry (table 2, column 7; figure 12). However, these sales data also provide other useful information.

Specifically, the retail value of world diamond jewelry sales has increased 11-fold since 1971. When the data are viewed in terms of world population, it can be seen that in 1971 annual diamond jewelry sales averaged almost $1.20 for each person on Earth; by 1996 this had increased to almost $9.00 per person (world populations for 1971 and 1996 estimated at 3.8 and 5.8 billion, respectively). Even allowing for inflation, this clearly demonstrates the recent strength of the world diamond jewelry market.

Figure 11 shows that world retail diamond jewelry sales increased by 86% between 1985 and 1988. This correlates with several significant events in the diamond industry, including a major expansion of the Indian cutting industry (again, see figures 4 and 8) and the Argyle mine's achievement of full production in 1986 (discussed further below).

Diamond Content (Polished Wholesale Value) in World Diamond Jewelry. Diamonds typically constitute only a relatively small part of the total retail price of the average piece of jewelry, although higher-quality goods (and solitaires) will have a higher diamond value as a percentage of the retail price than will lower-quality goods. The "diamond content" of jewelry is expressed as polished wholesale value (pwv), which is the wholesale value (in US$) of the diamonds contained in a piece of jewelry purchased at retail ("World diamond jewellery consumption," 1991). Diamond content can be expressed as a percentage of the retail value of a piece of jewelry. Thus, if the pwv in a piece is $23, and the consumer paid $100 retail for that item, then the pwv is 23%. For this article, world wholesale polished diamond sales (column 2) are expressed

as a percentage of world retail diamond jewelry sales (column 6) to obtain the diamond content (pwv) of jewelry, on a worldwide basis, for each year (column 7). Variations in the value of the diamond content (pwv) are plotted in figure 12. Three major groupings are evident.

- **1971–1980.** During this period, the diamond content (pwv) of jewelry worldwide averaged 29.7% of retail. This value, although typical in the past, is high by today's standards. For most of this period, Indian polished goods constituted less than 50% of total world diamond production (by weight; see table 1, column 6). At this time, however, mass marketers of diamond jewelry, whose products are characterized by low-value diamond contents, had not yet made a significant impact on the retail trade (Boyajian, 1988), even though a number of American retail chains had forged links with Indian diamond manufacturers as early as 1965 (Shor, 1993).
- **1981–1984.** The diamond content (pwv) averaged 13.5% of retail value during this period, but this low value is primarily an artifact of the way in which pwv is calculated. World wholesale polished sales (column 2), one of the two components in the calculation, were abnormally low because of "destocking" by retailers following the end of the 1979–1980 "boom," which resulted in values for pwv ranging from 12% to 14% (column 7).
- **1985–1996.** During this most recent period, diamond content (pwv) averaged 17.2%. Similar low values (compared to those from 1971–1980) are reported elsewhere; for example, values of 18% have been reported for both 1988 and 1989 ("World diamond jewellery consumption," 1991). Occasionally these values were somewhat higher: Pearson (1996a) reported 22%. These low values clearly reflect the changing character of the diamond jewelry market since 1985, and they unquestionably illustrate the strong influence of low-valued Indian goods in the marketplace.

DISCUSSION

Given the data presented above, we can now shed more light on the nature of the Indian diamond-cutting industry. As our template for this discussion, we will examine the three commonly accepted ideas that most of the diamonds cut in India are: (1) exported unset to foreign jewelry manufacturers, (2) small, and (3) of low quality.

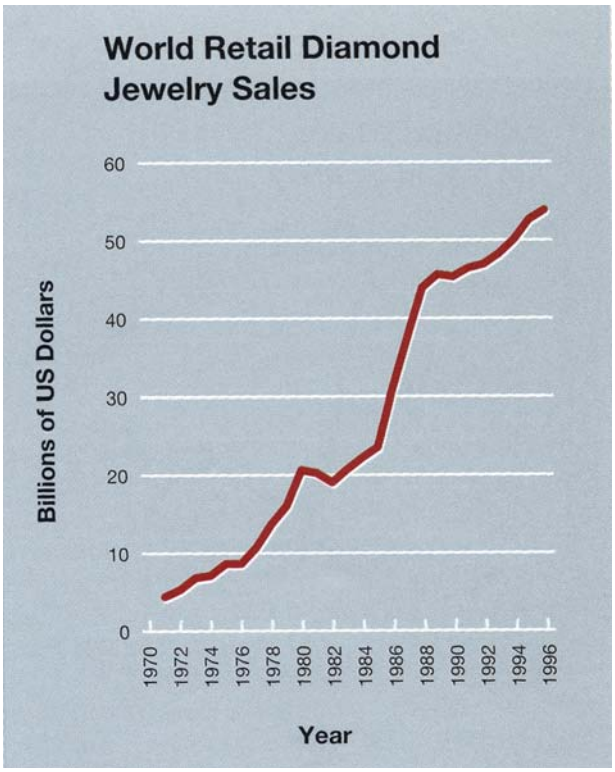


Figure 11. From 1971 to 1996, the retail value of world diamond jewelry sales increased 11-fold. This is due in part to the availability of an enormous quantity of diamonds from India. Data are shown in table 2, column 6.

Consumption of Diamonds Polished in India. *Local Diamond Consumption.* Historically, there has been a tradition of diamond consumption within India (Shor, 1993). In modern times, this has continued, particularly during periods of world chaos and stress. For example, in 1936 during the Great Depression, the United States and India were the principal buyers of polished diamonds (Ball, 1937; Shor, 1993). In the 1950s, diamonds were also used in India as a hedge against the deflating rupee ("Small diamonds, big business," 1995).

Yet there are very few published (and no official) data indicating that any of the diamonds polished in India since the start of the modern diamond cutting industry there (i.e., the late 1950s) are retained for local use by the Indian population, in general, or the wealthy in particular. Officially it is assumed that all imported rough diamonds are polished and then exported.

However, statements in the literature indicate

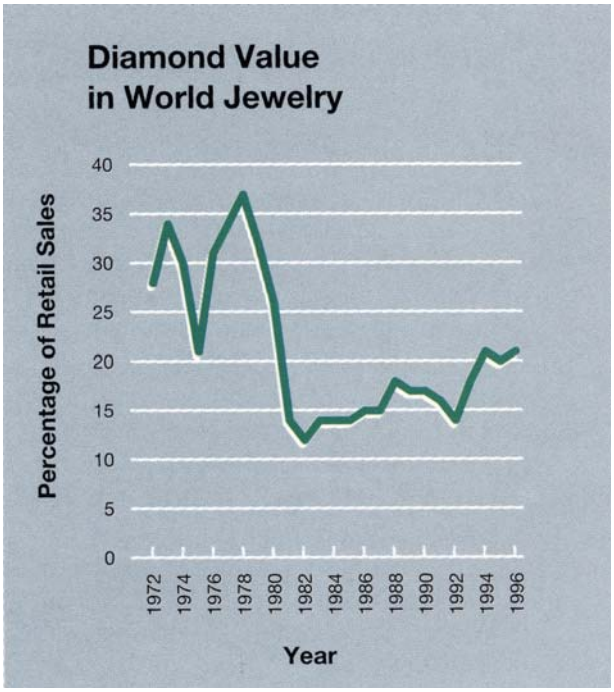


Figure 12. The diamond content (polished wholesale value) as a percentage of world retail diamond jewelry sales dropped from an average of 29.7% in 1971–1980 to a low of 13.5% in 1981–1984. Since then, it has averaged 17.2%. Based on data in table 2, column 7.

that there is a thriving local market not only for the local polished production but also for larger, good-quality stones (e.g., "The sweat behind the glitter," 1988) that may not have been polished locally. One estimate is that in the late 1980s, 10% (by weight) of diamonds polished in India were diverted into the local jewelry trade ("India expands on all fronts," 1989). According to our calculations from data presented by Sharma (1991), in 1989 this figure was about 6% (800,000 ct out of 13 million ct), or about 4% of the world total.

In our discussions with Indian diamond dealers (who wish to remain anonymous), we get the impression that today a figure of 10%–15% by value is realistic for the amount of local diamond production that is diverted for domestic consumption; many of these are of good quality. Thus, we conclude that India presently has a vibrant domestic market for diamond jewelry. We estimate that it is about 10% by value of its exports, which includes foreign polished goods as well; by weight, it is probably about 5%, as better qualities are sought for the local market.

It is interesting to note that even if only 5% of India's population of about 900 million has sufficient wealth to purchase diamonds, an estimated 45 million people would be potential buyers of diamonds. The purchase of gold and silver jewelry for special occasions is a cultural tradition in India, and there is no doubt that diamond jewelry has great potential for use in this regard in the domestic Indian market. In fact, a recent report ("Indian fact-file," 1997) indicates that India is presently the sixth largest diamond jewelry market in the world, which would be about 2%–3% of the world market, and comparable to the individual markets in Germany, Great Britain, and France.

In light of these observations, India should have appeared in every compilation of worldwide diamond jewelry markets; however, this has not been the case. One compilation published for 1992 ("U.S., Japan fuel diamond jewelry market," 1994) is typical of those for the previous several decades: It lists the diamond market share for 25 countries worldwide, with no mention of India. In 1995, for the first time, India was listed in 10th position, with 1% of the world's retail diamond jewelry sales ("Japan holds the key," 1997). Given the likelihood that India is indeed the sixth most important retail market for diamonds in the world, the question arises: "How could this omission have occurred?"

The "Gray Market." Several examples in the literature (e.g., "India expands on all fronts," 1989; Miller, 1995) indicate that import and/or export figures may not be accurately reported. Above we gave evidence that there likely is a large (about 10%) "gray market" of diamonds manufactured in India, that is, a "leakage" of Indian polished diamonds to the local market (both retail and wholesale, probably), although some may be exported subsequently through unofficial channels. However, there has been no import duty on rough since 1983, and there are no taxes on exports or on profits from export earnings (see Background), so relatively little is to be gained from unofficial exports.

There are, however, taxes on other profits, and various methods are used to avoid them. Thus, some lapidaries may overinvoice on rough (or underinvoice on the cut diamonds) to offset some of the income on the polished goods, or they may report less yield than they actually get (Kaye, 1988). If, for example, in 1996 the polished yield from rough manufactured in India was actually 19.6% instead of the reported 18.6%, an extra 1,000,000

carats of polished diamonds could enter the gray market without appearing in official statistics. This would represent about 5% (by weight) of the world's total polished production for that year! The stones that are not reported often do enter this gray market. As in many countries worldwide, the small size and high value of diamonds makes them an extremely portable—and easily hidden—source of wealth, particularly useful when investing abroad or trying to minimize tax liabilities.

Diamonds Used in Manufacturing Jewelry for Export. Before 1989, essentially all diamonds cut in India (except those kept for local consumption and/or the gray market) were exported unset to foreign jewelry manufacturers. However, this situation is changing, as there is now a jewelry manufacturing industry in India designed for the foreign market (figure 13). Much of this activity (figure 14) is located in the Santacruz Electronics Export Promotion Zone, commonly known as SEEPZ (Shor, 1994; "From strength to strength," 1996). The amount of Indian polished consumed since 1989 by this jewelry manufacturing industry is relatively small—8% or less of total diamond production by weight (Shor, 1997)—but this is likely just the beginning of a long growth phase that will consume increasing amounts of locally polished diamonds. As the jewelry manufacturing industry expands, even fewer polished diamonds will be exported unset.

Sizes and Number of Diamonds Polished in India. Contemporary India has typically manufactured very small polished diamonds, some even smaller than 400 stones per carat (spc; e.g., Gupte, 1988). Most of the recent reports indicate that the smallest stones are in the range of 200 spc (e.g., Shor, 1993), the cutting of which clearly requires extraordinary skill. In the early days (since the late 1950s) of the modern Indian cutting industry, 30%–35% of the Indian output was single cuts (Stuyck, 1969). More recently, however, even the smallest sizes are likely to be full cut (e.g., McDonald, 1993). During the 1990s, the average size of all stones cut in India has been given as anywhere from 50 spc (i.e., the average stone is 2 pt; Miller, 1995) to 38.5 spc (i.e., the average is 2.6 pt; calculated from Sharma, 1991, who stated that India produced 500 million polished stones totaling 13 million carats). For our general purposes, we assume that in the 1990s the average is 40 spc, that is, 2.5 pt.

Notwithstanding these small average sizes, in recent years Indian factories have been cutting some larger and better qualities of rough. By 1989, about 10% of rough imports were said to be large enough to be sawables ("India expands on all fronts," 1989). Thus, the size of rough polished in India has increased over the past three decades. We believe that, overall, this results in larger cut sizes (even though we recognize that because sawables yield two stones per crystal, and thus have a higher yield, they may not produce as large a cut stone as a nonsawable of the same weight from which only one stone is obtained). Pravin Mehta, of New York's Occidental Gems, estimated in 1988 that 20% of the diamonds (by weight) polished in India were over 10 pt ("The sweat behind the glitter," 1988). Evidence for this can also be found in imports into the United States, the main buyer of polished (unset) diamonds from India. In the six-year period 1978–1983 (the earliest years for which we have the appropriate data), a total of 114,927 carats of polished (unset) diamonds over 0.5 ct were imported into the U.S. from India. During the 1991–1996 period, that total reached 1,004,950 carats—an almost 10-fold increase. (Numbers calculated from data in U.S. Bureau of Mines, 1979–1984, 1992–1994, 1995; U.S. Geological Survey, 1996, 1997.)

If we accept the fact that Indian polished diamonds average about 2.5 pt (40 spc), we can combine this information with the total number of carats that are polished each year (see table 1, column 3) to estimate the number of diamonds polished annually in India. Specifically, for 1996, the 18.88 Mct of polished goods that India exported represent about 755 *million* stones.

Quality (Dollar Value) of Stones Polished in India. There are many statements in the literature to the effect that the quality, and hence value, of stones polished in India is low, although there are few quantitative data on this subject. Sharma (1991), for example, states that most of the Indian polished diamonds have poor clarity (I grades) and color (M-N grades are common). The fact that India exported 18.88 Mct in 1996 (table 1), for a total value of $4,235 million (table 2), indicates an average value of $224 per carat (table 2). For all of 1996, the "high cash asking" price (from the monthly *Rapaport Diamond Report*) for small stones (1–3 pt) in the lowest category (M-N color, I_3 clarity) was $170 per carat; this rose to $350 per carat for K-L, I_2. (In recent months, prices for these categories have fallen dramatically. In the January and February 1998 issues of

Figure 13. Many companies are now involved in India's jewelry manufacturing industry. These rings were produced by, from top to bottom: Simplex Diam Inc., Precise Gem & Jewel Pvt. Ltd., Kama Jewellery (India) Ltd., Ornamentations (India) Pvt. Ltd., Sanghavi Diamonds Inc., C. Mahendra Jewels, Uni-Creation Inc., Titan Jewelry, Uni-Creation Inc., and Su Raj Jewelry. Courtesy of the Indo Argyle Diamond Council.

the Rapaport Diamond Report, the asking prices were $100 and $270, respectively.)

Allowing for the usual 25% "selling" discount from the above 1996 "high cash asking" prices, the resulting prices per carat ($127.50 and $262.50) are consistent with the conclusion that, by far, the largest portion of Indian diamonds (average of $224 per carat in 1996) are of the lowest qualities (K–N, I_1–I_3), although there is a substantial portion, perhaps as much as 10%, of better-quality goods.

FUTURE SOURCES OF ROUGH DIAMONDS FOR THE INDIAN DIAMOND CUTTING INDUSTRY

The cutting industry in India is almost entirely dependent on imported rough diamonds for export product. By the time diamond mining started in Brazil in 1730, production from India had declined to insignificance because the mines were worked out. Although organized diamond mining resumed at India's Panna mine in 1961, modern production has never exceeded 20,000 carats annually. Even if that entire quantity were cuttable, it would be consumed by the present cutting industry in about 1.7 hours! (Based on the import of 101 Mct of rough in 1996, the industry presently consumes 11,500 ct/hour, or almost 200 ct/minute.)

For India to maintain its position as the largest supplier of polished diamonds in the world, with a near-monopoly in smaller stones, a constant supply of appropriate rough is required. The availability of such supplies will depend on the discovery of new deposits to replace those that become exhausted.

Several publications have predicted that the Russian stockpile is nearly depleted (see, e.g., Miller, 1995; Picton, 1997). One of these ("Russian diamond stockpile. . .," 1997) states that it has not been replenished since 1991 and will be gone by mid-1998. This should reduce the current surplus of near-gems for the Indian cutting market.

The Argyle mine is expected to produce about 35 Mct of diamonds annually from 1997 ("No need to fear. . .," 1996) until about 2003, but beyond that its future is uncertain. In 2003, the open-pit mine (figure 15) will have reached its economic limit, about 300 m below the original surface. There are two plausible options for mining to continue. One involves some type of underground mining, but the diamond content (grade) of the ore below 300 m is 3.7 carats per tonne ("Ore reserves . . .," 1996). This is significantly less than the grade from current production (about 6 ct/tonne) and portends an uneconomic mine. The second option involves extending the present open pit to access deeper ore ("Underground operations in doubt . . .," 1997). In either event, annual production after 2003 will decline, perhaps to about 20 Mct annually, and will last for about five to 10 years depending on the mining method selected. It is also possible that the Argyle mine could close earlier should there be, for example, a severe erosion in the price brought by Argyle rough.

At present, more than 90% of Argyle's rough reportedly ends up in India, with 70% of the approximately 250,000 people in the diamond cutting industry in Ahmadabad alone reportedly employed in manufacturing Argyle diamonds ("Argyle Diamonds industry review 1997," 1997). This is

particularly interesting, inasmuch as in the past only about 40%–45% of Argyle diamonds were considered near-gem with 5% gem and the rest industrial (Boyajian, 1988). Clearly, Indian manufacturers are cutting ever-lower qualities of diamonds, probably with lower yields, especially those originating at Argyle that were previously classified as industrial.

There is no doubt that at the present time the near-gem market is still burdened with a huge stockpile of rough (as well as polished) diamonds. For example, Even-Zohar (1997) estimates the inventory of Argyle at 80–90 Mct. Nevertheless, we foresee a shortage of near-gem rough for the Indian cutting industry, perhaps as early as 2003, when the Argyle mine may close. At best, it will produce at about half its present rate. Others (e.g., "Diamond demand set to outstrip supply," 1996) predict a shortage of rough in general (as opposed to near-gems only) by the year 2000.

There is no major new mine in an advanced stage of development that could produce the volume of near-gem rough needed to replace that of the Argyle mine within six years. The announcement by De Beers that production will increase at the Orapa mine in Botswana ("Orapa capacity to double," 1996) may mean that they, likewise, anticipate a shortage of lower-quality diamonds, as the production at Orapa is over 92% near-gem or industrial ("Diamonds today. Part 1," 1992). This expansion will add about 6 Mct annually to the world's supply, but it will only partially replace Argyle's much larger contribution. Similarly, the Diavik mine, likely to start operations in 2002 as Canada's second diamond mine, should add about 8 Mct annually of quality similar to that of Orapa for 16–22 years ("Aber spends big," 1998). However, as the value of the diamonds produced at Orapa ($50 per carat; Janse, 1996) and Diavik ($56 per carat; "Aber spends big," 1998) is far greater than that of the Argyle diamonds ($9 per carat; Janse, 1996), a direct comparison cannot be made based solely on the volume of rough production.

The prospect of a possible shortage of near-gem rough for the Indian cutting industry in the early part of the next century raises numerous ancillary concerns and implications. These include: the social implications of additional unemployment in a society that can ill afford it; the likelihood that there will be a negative impact on the foreign exchange generated by the diamond cutting industry (presently one-fifth of India's total; Pandya, 1997); the prospect of higher prices for some Indian goods; the possibility that synthetic diamonds may be cut and sold in place of natural diamonds; and the possibility that India will start to cut larger, higher-quality rough diamonds, such as those that will originate from the Orapa and Diavik mines. However, the potential effect on the world retail diamond jewelry industry is of greatest concern, because the fastest-growing segment of the diamond jewelry market—low-priced diamond jewelry—depends on the small, inexpensive stones that have been the foundation of the modern diamond cutting industry in India.

Figure 14. Today, India's leading diamond companies manufacture finished jewelry in such modern, well-equipped factories as this one at SEEPZ (Santacruz Electronics Export Promotion Zone). Photo by Russell Shor.

CONCLUSIONS

Aside from the discovery of large diamond deposits in Russia, Botswana, and Australia, we believe that nothing has had a more fundamental impact on the diamond industry in the latter half of the 20th century than the spectacular growth of diamond cutting in India, which was essentially nonexistent 35 years ago. Today, primarily as a result of a large supply of low-wage, skillful workers, India is the premier cutting center for small, low-quality diamonds: It accounts for about 70% of the world's polished diamonds by weight and about 35% by wholesale value (excluding the effects of recent surpluses of Russian rough in the market).

Figure 15. The influx of small, low-quality near-gems from the extraordinarily productive Argyle mine has helped supply the growing diamond cutting industry in India. The large open pit at Argyle, shown here, will probably not be workable by present means after the year 2003, which raises important questions for the future of the Indian diamond cutting industry. Photo courtesy of Argyle Diamonds.

In 1996, Indian cutters produced about 750 million polished diamonds (about 9 out of every 10 polished diamonds in the world), the vast majority of which were less than 3 pt. If the cutting industry in India had not developed, most diamonds now classified as "near-gems" probably would have been used for industrial purposes. These small, low-quality polished diamonds have spawned a new segment of the diamond jewelry market that is characterized as readily affordable and amenable to mass marketing. The future of the Indian cutting industry (and, thus, of the low-priced diamond jewelry segment of the world diamond industry) appears to be secure at least into the early years of the 21st century. It depends, though, on a reliable and abundant supply of near-gem rough produced in other countries.

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