

SKILLS IMPLICATIONS OF BOTSWANA'S DIAMOND BENEFICIATION STRATEGY

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Outputs of the “Skills for Economic Growth and Diversification in Botswana” analytical work:

Policy Note 1: “Raising Botswana’s Human Resource Profile to Facilitate Economic Diversification and Economic Growth”

Policy Note 2: “Labor Market Signals on the Demand for Skills”

Policy Note 3: “Skills Needs of the Private Sector”

Policy Note 4: “Skills Implications of Botswana’s Diamond Beneficiation Strategy”

Summary Report

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Abbreviations and Acronyms

BOTA	Botswana Training Authority
DTCB	Diamond Trading Company Botswana
MoESD	Ministry of Education and Skills Development
NDP	National Development Plan

All dollar amounts in U.S. dollars unless otherwise indicated.

Context of the Study

Human development is one of the pillars of Botswana's Country Partnership Strategy with the World Bank (2009–13). The Country Partnership Strategy (CPS) is in line with Botswana's "Vision 2016," which, in terms of human development, envisions the transformation of Botswana to "an educated and informed nation" and to "a prosperous, productive and innovative nation" as two key cornerstones of the strategy. In line with these objectives, the World Bank with support from the Ministry of Education and Skills Development (MoESD) embarked on analytical study entitled "Skills for Economic Growth and Diversification in Botswana." The work is informed by Botswana's need to diversify its economy to facilitate stronger, more sustainable economic and employment growth and, concurrently, equip its workforce with a variety of skill sets that meet employer needs.

The objective of the exercise is to provide the government of Botswana with concrete suggestions for policy interventions that strengthen the skills base of the workforce and thus facilitate economic growth, diversification, and employment. The recommendations offered by this and the other notes that make up the study, are based on analyses of available data and international best practices. Four policy notes were developed, each of which touches on crucial aspects of strengthening the country's skills base: "Raising Botswana's Human

Resource Profile to Facilitate Economic Diversification and Growth" (note 1), "Labor Market Signals on the Demand for Skills" (note 2), "Skills Needs of the Private Sector" (note 3), and "Skills Implications of Botswana's Diamond Beneficiation Strategy" (note 4). The key findings and recommendations of these four notes were then integrated into a short Summary Report.

The first note assesses the strengths and weaknesses of Botswana's education system (i.e., basic, technical and vocational, and higher education) and recommends policy interventions to strengthen students' acquisition of relevant knowledge and skills. The second note examines both current labor and skills demand (based on available labor market data) and expected skills demand (based on the government's economic strategies). On the basis of this analysis, the note offers recommendations on skills development and government programs. The third note uses the findings of an employer-employee survey conducted in Botswana in 2010 to identify skills needs and gaps from the viewpoint of the private sector. The last note examines the skills implications of the government's diamond beneficiation (processing) strategy and suggests actions that can be undertaken to ensure that the nation's skills base supports, rather than hampers, implementation of the strategy.

1. Overview

Botswana is one of the most successful economies in Africa and worldwide, but its rapid growth has depended on abundant natural resources, particularly diamonds, which have been generating nearly half of its fiscal revenues. Diamond revenues have enabled the country to develop from one of the world’s poorest countries to reach middle-income status. Historically, Botswana’s diamonds have been exported as rough diamonds, with minimal value-added processing taking place in the country. The government of Botswana is currently seeking to change this situation.

To prepare the country for “life after diamond mining,” the government has developed a new growth paradigm based on the creation of a skilled workforce, diversification of the economy, and strengthening the private sector. Being aware that its growth strategy would need to change, in 1996 the government adopted “Vision 2016,” a strategy document that envisions the transformation of Botswana into “an educated, prosperous, productive, and innovative nation.”

Translating this vision into concrete actions, the National Development Plan 9 (2003–08) focused on economic diversification and labor-intensive growth, and the current plan (National Development Plan 10, 2009–2014) aims to enhance national competitiveness by strengthening human resources and building a knowledge-based economy.¹ Mineral beneficiation (processing)—specifically, diamond beneficiation—was declared a national policy in 2008 as part of the new growth paradigm. Through this process, the government aims to increase employment and develop skills for downstream processing that will ensure the sustainability of Botswana’s diamond industry when actual diamond mining comes to an end over the next two decades. In short, the strategy seeks to have 15 percent of the country’s rough diamond output cut and polished locally. The cutting and polishing industry is more labor-intensive than diamond mining and can remain sustainable even when raw diamond resources have been depleted.

This note examines the skills implications of the beneficiation strategy, particularly those of diamond cutting and polishing. In addition to reviewing the government’s plans to develop downstream activities and their implementation, the note offers employment projections based on the potential success of diamond beneficiation efforts. For this purpose, an input-output simulation is used to show how output linkages arising from the production of polished diamond exports will impact labor in various sectors of the economy. The analysis is based on primary data and information collected through interviews with relevant stakeholders in the diamond industry, as well as secondary data from official sources.

The note suggests that in the last five years, Botswana has made considerable progress in establishing a local cutting and polishing industry, but that the success of this industry depends on the creation of concomitant skills. By 2010, the industry had already created close to 3,000 direct jobs in 16 cutting and polishing factories, in line with governmental targets. The input-output simulation shows, that the output linkages arising from the input demands associated with processing rough diamonds, valued at

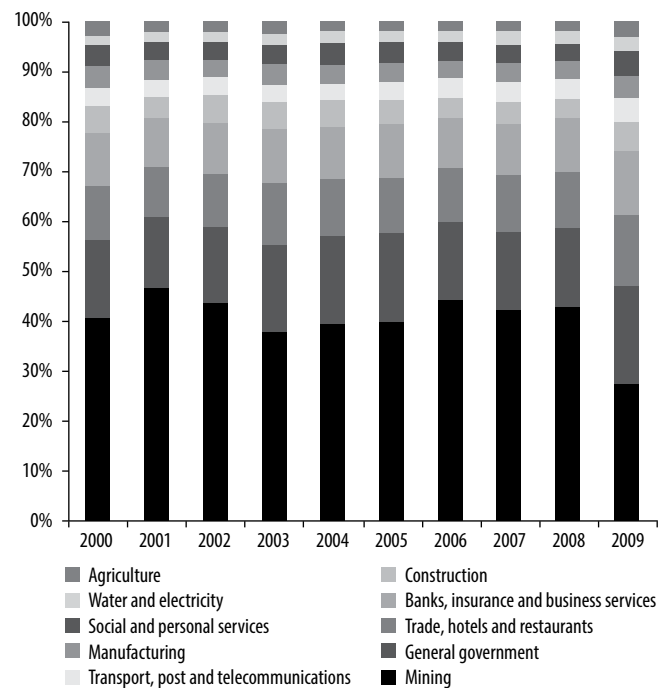
\$550 million by the 16 aforementioned factories has the potential to create over 6,000 indirect jobs in the country.²

The cutting and polishing industry is still in the development phase and needs a dynamic policy environment in order to remain relevant at all stages of its development. Policies are needed in particular to: create industry-specific skills (with clear skills transfer targets, or deadlines), establish technology links between the diamond hub and the innovation sector, facilitate rough diamond trading, and expand the capacity of the Botswana Training Authority (BOTA) to accredit cutting and polishing programs within industry factories.

2. Motivation for Beneficiation in Botswana

Botswana’s diamond-led growth has resulted in an undiversified economy dominated by diamond mining, with public spending largely financed by diamond revenues. However, the country has managed to escape the “resource curse” because the discovery of diamonds was bolstered by political stability, mature democratic processes, good policies, and strong institutions that underpinned effective economic management for over four decades. Diamond revenues financed key infrastructure development, such as the building of roads, schools, and hospitals, as well as the creation of an extensive welfare system for a population of roughly 2 million (more than half of which is urbanized).

Figure 1. Contribution to Gross Domestic Product of Different Economic Activities, 2000–2009
(percentage)



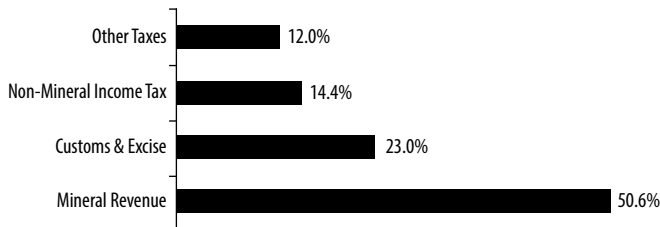
Source: Central Statistics Office (2008a).

1 Additional goals of NDP 10 include enhancing well-being, social protection, security, transparency, and governance.

2 The \$500 million figure is Botswana’s current target for its Diamond Trading Company.

Although Botswana does mine other minerals (copper, nickel, gold, and soda ash), diamonds represent over 90 percent of all mineral revenues, which themselves contribute roughly 50 percent of all government revenues (figure 2).

Figure 2. Composition of Government Revenue, 2000–2009
(percentage)



Source: Central Statistics Office (2008a).

However, Botswana’s diamond-led growth is under threat, as diamond revenues are expected to start decreasing in the next decade when open-cast mining will be replaced by underground mining. Unless there are major new raw diamond discoveries, revenue from diamond mining will decline, at first slowly and then rapidly over the next two decades (figure 3).

In light of the approaching resource depletion, it is crucial that Botswana use its remaining diamond resources to foster economic growth and fiscal sustainability in the private sector. The government considers downstream beneficiation, or the local processing of diamonds, an opportunity for private sector growth that can create sustainable revenue for the government. The beneficiation imperative will further local economic development through the local cutting and polishing of diamonds, ensuring that a greater proportion of the value derived from diamond exploitation stays “in country” and benefits the country by increasing employment. The beneficiation strategy thus seeks to create downstream competencies that can continue to be used when diamonds are no longer mined in Botswana.

The beneficiation strategy also includes facilitating services to increase diamond products, trading activities, and the number of downstream factories. The downstream industry will include “one-stop-shop” diamond cutting and polishing factories; diamond jewelry manufacturing; rough and polished diamond trading centers; and the national Gemological Facility. The downstream factories are expected to increase skills and technology transfers, as indicated by the number of citizens that they employ and the level of industry competitiveness.

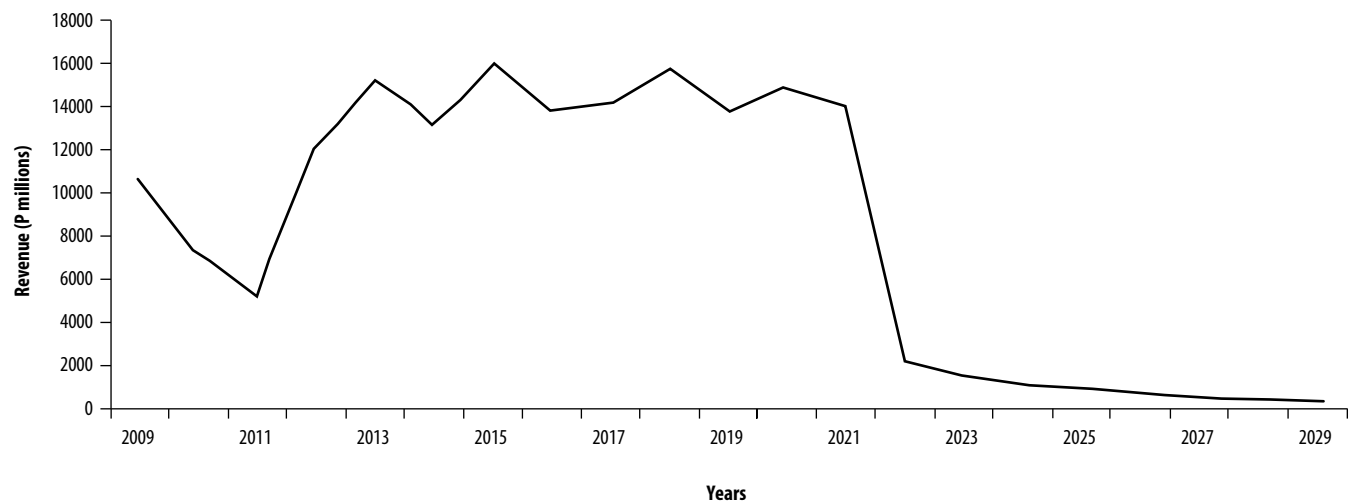
3. History of Botswana’s Diamond Cutting and Polishing Industry

Diamonds were discovered in Botswana by the DeBeers Group of companies in the mid-1960s. Diamonds are mined through a 50-50 joint partnership by the DeBeers Group with the government known as the Debswana Mining Company. Since the early 1980s, the government has been eager to establish a cutting and polishing industry to create more employment opportunities in the sector. At the time, DeBeers did not support the government’s ambitions, arguing that cutting and polishing activities were not economically viable in Botswana. Negotiations between the two partners led to the start of three such factories between 1980 and 1990, but none ever reported a profit.

Despite this failed attempt, lessons were learned and the government continued to push DeBeers for beneficiation. Botswana’s real opportunity in this sphere came in 2005, when DeBeers’ 25-year mining license was due for renewal. The government made the renewal of its mining license for another 25 years contingent on the company helping Botswana create a viable cutting and polishing industry. As a result of the new agreement, the Diamond Trading Company Botswana (DTCB) was established in 2008. In order to help support the new industry, DTCB is responsible for local sales and marketing of diamonds in the country. DeBeers funded the construction of the new DTCB building at a cost of \$83 million.

The new agreement specifies that DTCB’s rough diamond

Figure 3. Projected Government Revenue from Diamonds, 2009–2029



Source: Government of Botswana (2008)

sales to the local manufacturing industry must be at least \$500 million a year, with the goal of creating over 3,000 jobs. After the new contract was signed, the government invited 16 of the world's most renowned cutting and polishing companies to set up factories in Botswana and transfer cutting and polishing skills to local laborers (table 1). The 16 companies, known as "sightholders," are only assured rough diamond allocations on the condition that they hire and train local residents. To date, these companies have invested in factories and are training locals in cutting and polishing skills; by the end of 2008, they employed 3,178 people. Employment had decreased to 2,489 at the end of the 2009 due to the impact of the global recession, but rose to around 3,250 in 2011 as the demand for diamonds increased (Office of the President 2011).

The office of the "diamond hub," located in the heart of the diamond in Diamond Technology Park, supports the government's beneficiation policy. The office builds strategic alliances, develops infrastructure, and works to create an enabling fiscal regime for the diamond industry. The office also houses various ancillary businesses, including banks, logistics, gemology, and security brokerage firms.

Table 1. Botswana's Cutting and Polishing Factories

Company	Origin
Dalumi Botswana	Israel
Diamond Manufacturing Botswana	Belgium
Eurostar Botswana	Belgium
H&A Cutting Works Botswana	Thailand
Lazare Kaplan International (LKI) Botswana	Israel
Leo Schachter Botswana	Israel
Motiganz Botswana	Israel
Pluczenik Botswana	Belgium
Rand Diamonds Botswana	South Africa
Sherenuj	India
South African Diamond Corporation (SAFDICO)	South Africa
Steinmetz	Israel
Suashish	India
Te mane Manufacturing Company	Belgium
Yerushalmi Bros Botswana	Israel
Zebra Diamonds	Belgium

Source: Mbaya (2011).

Note: The 16 companies include the 3 factories that were created during the government's previous failed attempt to establish a cutting and polishing industry.

In the five years that followed the new agreement with De Beers, Botswana made considerable progress in establishing a local cutting and polishing industry. However, the most critical part of the government's plan is to develop the skills needed by this industry and its related activities in order to create world-class downstream competencies. The success of the industry hinges on the development of these skills. This note

now looks at the skills implications of this nascent industry by evaluating its demand for direct and indirect labor, together with that of related activities.

4. Skills Implications of the Cutting and Polishing Industry

This section is based on primary data obtained through interviews with 10 of the 16 cutting and polishing factories, as well as official secondary data. The skills implications of indirect job creation are evaluated using an input-output simulation to show, how an increase in final demand associated with polished diamond production, will impact employment in other industries that supply the cutting and polishing factories with various inputs.

Direct skills implications

To understand the direct skills implications of the new industry, a brief description of the cutting and polishing process is needed. A diamond is cut and polished in a series of steps to prepare it for jewelry manufacturing. First, the rough diamond is examined to determine the biggest or best shape that can be achieved. Once this is determined, the diamond is marked and cut using either a saw or a laser machine. The next step is bruting, where two diamonds are rubbed together, either in a lathe-type machine or an automatic bruting machine, to create a girdle around the circumference. Finally, all facets are polished and finished. Cutting and polishing a diamond is a long and exact process that requires patience and precision; these skills are developed over time and experience plays a key role. An empirical examination of the Israeli diamond industry supports the argument that productivity and skills in the cutting and polishing industry are determined by experience (Levhari and Sheshiniski 1973).

Technical and skilled jobs

The cutting and polishing factories recruit locals who they train to become markers, bruters, sawyers, diamond polishers, computer programmers, and laser operators. The local laborers recruited for technical and skilled jobs require a low level education (standard 7 or form 3), good English communication skills, good eyesight, good dexterity, and a basic knowledge of mathematics, physics, and computers. Technical expertise is gained through experience in the industry; therefore low labor turnover is critical.

Professional jobs. Professional jobs are in upper and middle management. Some firms have foreign management staff, while others have local management staff. Supervisors are mainly expatriates; they are responsible for overseeing people working in technical, skilled, administrative, and entry-level positions. These experienced expatriates have previously worked in various positions in the industry in other diamond centers around the world. They have technical and professional training and are guided by industry standards. Other professional positions are available in support services (e.g., accountants, human resource specialists, office administrators). The demand for support services varies with the size of the factories, where the labor force ranges from 60 to 400 employees.

Table 2. Indirect Employment Effects of Diamond Cutting and Polishing Industry

	All sectors	Banking, insurance, and business services	Manu-facturing	Wholesale/Retail trade, hotel & restaurant sector	Transport & communi-cations	Water & electricity
New jobs	6,035	1,836	1,047	762	294	126
Change in employment (%)	1.7%	15.7%	3.5%	1.1%	3.8%	4.5%
Professional & technical employees	816	268	132	109	43	17
Administrative & management employees	170	56	28	23	9	3
Clerical employees	496	163	80	66	26	10
Skilled manual employees	2,577	847	417	344	137	54
Unskilled employees	1,596	511	288	221	78	41
Mixed-income employees ^a	379	0	101	0	0	0

Source: 1996–67 Labor Force Survey.

Note: The Labor Force Survey of 1996–97 was used as the basis of these estimations because the input-output model incorporates the social accounting matrix of that year 1996–97.

Training in the factories is on the job, with experienced expatriates responsible for teaching local employees the specific tasks of the cutting and polishing process. Skills are firm-specific and factories recruit highly skilled expatriates from their global operations, with the government assisting the firms to obtain work permits.

Indirect skills implications

To understand the indirect skills implications associated with the production of polished diamonds, a brief review of the inputs of a typical cutting and polishing factory is needed. The cutting and polishing factories purchase a box of rough diamonds, called a “sight” box, once a month during the DTCB’s “Sight Weeks.” The factories must hire a sight broker to facilitate the purchase of these diamonds. It typically takes a factory 3 to 4 months to cut and polish the entire sight. During that time factories require manufactured inputs, such as diamond glue and polishing wheels, water and electricity, security for the premises, catering for the staff, general telecommunications, and insurance. They also require financing and transportation for the rough diamonds once they have been purchased, and again when they export those that have been polished.

5. Input-Output Simulation

The input-output analysis detailed here focuses on the production effects of the diamond cutting and polishing industry and does not include the income effects. The focus on the production side assumes that intermediate input demand and employment are endogenous, while final demand is exogenous. The modeling framework allows for an estimation of the consequences of an exogenous change in the economy, in this case, an increase in polished diamond exports. Supply linkages include the development of ancillary firms that provide the cutting and polishing industry with necessary goods and services. (Details of the model and its assumptions are provided in appendix 1.)

The findings of the simulation show that demand for inputs by the cutting and polishing factories has the potential to create over 6,000 jobs across all sectors of the economy.³

³ See appendix 2 for specific employment calculations by sector.

Based on the model, skilled manual workers would benefit most from job creation, gaining 2,577 jobs, or 42 percent of total new jobs, while the sector that would benefit most is that of banking, insurance, and business services (1,846 jobs, or 30 percent of all new jobs).

Caveats

There are certain caveats to these job creation estimates. First, the Leontief function for labor, which reflects employment-output elasticity, is valued at 1 for all sectors and the economy as a whole; in reality, however, this function is typically less than 1 and differs among sectors. Therefore, the assumption may lead to an overestimation of the number of new jobs created. Second, the simulation focuses only on the production and not the income effects of the cutting and polishing industry. However, the income effects associated with increased household consumption, which result from both direct and indirect job creation, will ripple through the economy and increase demand for various goods and services. This increased demand may result in additional jobs in various sectors. Not accounting for income effects may therefore lead to an underestimation of the number of jobs created. The simulation also uses an unchanged value for productivity in Botswana. The next section provides a “reality check” on the estimates in table 2 by comparing the indirect and direct skills implications of the input-output model with actual developments in Botswana’s cutting and polishing industry and related activities.

6. Current Status of the Industry

As noted earlier, existing cutting and polishing factories in Botswana were licensed on the condition that they train local employees in cutting and polishing skills. The prerequisite for this process is the existence of high-quality training programs. The Botswana Training Authority (BOTA) is responsible for accrediting diamond cutting and polishing programs for companies in the downstream industry. Yet till 2010, only three factories and the DTCB have accredited training programs with BOTA (table 3). BOTA does not have figures for

the number of local employees who have completed or are completing the accredited programs. In an interview with 'sightholders', one factory noted that the costs of registering programs for accreditation and the hassle of doing so are some of the reasons that explain low registration numbers.

**Table 3. Botswana Training Authority (BOTA)—
Accredited Training Programs in Sector**

Company	Accredited training programs
DTCB Diamond Academy, Gaborone	Foundation Manufacturing Intermediate Manufacturing Pre-RTOP Advanced Manufacturing Rough Diamond Sorting and Valuing
Eurostar Botswana	Diamond Polishing
SAFDICO	Certificate in Diamond Processing Automatic Machine Polishing Preparation Brilliantteering Cross Work Fancy Stone Making Sawing
Teemane Manufacturing Diamond Training School, Serowe	Diamond Polishing

Source: Information provided by BOTA in 2010.

Expatriate labor

Expatriate labor costs more than local labor, therefore the factories have a real incentive to ensure that skills transfers takes place as quickly and efficiently as possible. Based on interviews, the ratio of expatriates to locals at the end of 2009 for the 7 factories that provided data on this topic ranged between 1 to 5 to 1 to 25 (table 4). The government hopes that over time, this ratio will increase further, with more Botswana replacing expatriates.

**Table 4. Expatriate-to-Local Ratios
for 7 Cutting and Polishing Factories**

Factory	Ratio
1	1:10
2	1:50
3	1:21
4	1:21
5	1:50
6	1:20
7	1:25

Source: Research conducted by author.

Note: These ratios reflect employment figures obtained from the factories; the names of the factories are withheld out of competition concerns.

Indirect job creation

In addition to direct employment in the cutting and polishing factories, the downstream beneficiation of diamonds has the spillover effects of creating opportunities for firms that either contribute to the industry's supply chain or work with companies that supply the industries with goods and services. The strategic thrust of the beneficiation strategy is to create opportunities for Botswana. However, the high degree of imported inputs in the process, barriers to entry in the supply chain, and lack of industry-related skills render this a difficult goal to achieve.

Imported inputs

The input-output simulation was based on the assumption that the local economy is able to supply the industry with all the goods and services required to produce polished diamonds. However, the local economy currently supplies the industry mainly with catering, cleaning, and security services. Manufactured inputs are being imported due to the lack of local suppliers. Although the government exempts import taxes on sightholders imported inputs, these firms still encounter difficulties in importing, which impacts production timelines. The servicing of equipment is also imported due to the lack of experienced local technicians. Depending on the type of servicing required, the sightholders either take their machinery to South Africa or bring in technicians from India, Israel, or Belgium to work on it. In either case, firms incur considerable costs to pay for the transport and visa requirements of these technicians. There is an opportunity here for Botswana to supply these much-needed skills, as all sightholders interviewed said that the local availability of technicians would improve the efficiency of their production by decreasing costs and timelines.

Supply chain barriers to entry

The supply chain of the cutting and polishing industry is characterized by high barriers to entry due to the closed nature of the diamond industry. Suppliers of knowledge-intensive services to the industry mainly consist of multinational companies that have existing relationships with sightholders in other cutting and polishing centers. Reputation and trust play a key role in determining who may participate in the supply chain. Currently in Botswana, ten suppliers of various knowledge business services have been identified in the cutting and polishing industry. All these companies operate in other cutting and polishing centers and opened offices in Botswana to provide their services to the factories of firms with which they have established business relationships.

The challenge created by high barriers to entry is exacerbated by the fact that the Botswana education system does not produce any industry-specific skills for the industry, rendering local labor ill-equipped for positions in these multinational companies.

Table 5. Identified Suppliers of Services to the Cutting and Polishing Industry

Company	Business activities
Brinks	Transport/logistics
Malaca Amit	Transport/logistics
I Henning	Brokers
Rothschild	Brokers
ABN AMRO	Banking
Standard Chartered	Banking
Stanbic	Banking
Gemmological Institute of America	Gem Certification
AON	Insurance
Marsh	Insurance

Source: Mbaya (2011).

7. Challenges of Skills and Job Creation

The main objectives of the cutting and polishing factories are to increase polished diamond exports and create a sustainable niche industry, which is one part of the country’s strategy for diversifying the economy away from mining. To date, Botswana has had modest success in inviting well-known sight-holders to participate in its downstream diamond processing industry. This success is derived from its leverage as an originating source of diamonds, as well as successful negotiations. The challenge is to now make the country competitive in the industry.

The last figure reported on polished diamonds exports by the diamond hub in 2008 stated that the DTCB supplied sight-holders with \$300 million (1.8 billion pula) worth of rough diamonds that year, but that only \$100 million (600 million pula) of polished diamonds were exported. There was thus a very large gap between rough diamonds sold locally and those polished and exported in 2008. This gap could indicate a number of bottlenecks in the manufacturing process of the nascent industry, one of which could be lack of appropriate skills. By June 2011, the annual sale of rough diamonds had increased to \$377 million; however, the relevant figure on polished diamond exports was not publicly available at that time, so it is unclear whether the gap has decreased over time.

A number of challenges need to be overcome before Botswana can become competitive in a market dominated by countries such as India and China, where the per-carat cost of processing diamonds is much lower. For instance, in China, the average cost of processing diamonds is \$17 per carat and in India, \$10 per carat. In contrast, Botswana’s cost stands at \$35–60 per carat. In general, part of the higher cost relates to the higher-quality product produced, but China also produces high-quality product and its lower cost is attributed partly to its use of high technology and a readily available skilled workforce.

Workforce development for the industry is clearly crucial for its sustainability. Skill needs range from expertise in cutting, bruting, and polishing, to the ability to operate and maintain machinery and equipment used in the production process.

Although the government supports work permits and visas for skilled workers in the industry to facilitate skills transfer to Botswana, the process of skills transfer should not be rushed. As mentioned above, skill development in the industry is a long and precise path in which skills are perfected with experience. Botswana needs to develop itself as a center of downstream diamond industries as well as product aggregation and sales (Office of the President 2011). This goal will be reached only when the country creates a brand name for itself as a producer of high-quality polished diamonds and jewellery.

Rough diamond sales

The diamond cutting and polishing factories in Botswana need an ongoing supply of the right diamonds in order to train workers and give them the necessary experience. Thus training is closely linked to the supply of rough diamonds. The sales and marketing arm of DTCB is responsible for determining the quantity and types of rough diamonds put into each factory’s box during Sight Weeks. The criteria used to determine individual supply levels for each sightholder includes global competitiveness criteria (i.e., technical, marketing, and distribution efficiency), as well as local criteria (i.e., skills development, job creation, and local manufacturing). In addition, sight-holders must satisfy certain other criteria, such as compliance with DTCB’s Best Practice Principles. The process of determining each sightholder’s supply is overseen by a governance panel comprising both government and DeBeers representatives in order to ensure fairness. The objectivity of the process has serious implications for the viability of the local cutting and polishing industry because the correct supply of rough diamonds is one of the key determinants of skills transfer in the industry.

Conclusion and Policy Recommendations

In the last five years, Botswana has made considerable progress in establishing a local cutting and polishing industry as part of its beneficiation strategy. To date, 16 cutting and polishing factories, a government diamond office, and a Diamond Technology Park that houses various ancillary businesses have been established. The industry has created close to 3,000 direct jobs in the 16 factories, a number in line with government’s targets. A large proportion of these jobs are for local workers who are being trained in technical and skilled jobs in the factories. Skills transfer in these factories takes place via on-the-job training provided by highly skilled expatriates. Training is directly linked to rough diamond allocations because trainees learn using real diamonds.

The input-output simulation conducted for this note shows that output linkages associated with \$550 million in annual local rough diamond sales and the associated input demands of cutting and polishing factories have the potential to create 6,000 indirect jobs in the Botswana economy. Almost half of these jobs would be for skilled manual workers, one-quarter for unskilled workers, and just over one-tenth for professional and technical workers. The sector that would benefit the most from ancillary job creation is that of banking, insurance, and business services, in which 30 percent of all new jobs are expected to be created, followed by manufacturing (17 percent of all new jobs); the wholesale, retail trade, hotel

and restaurants sector (13 percent), transport and communications (5 percent), and water and electricity (3 percent).

However, a large number of potential jobs are not being realized due to high barriers to entry in the industry, lack of industry-specific skills in Botswana, and the high import content of the industry. The diamond cutting and polishing industry remains in the development phase. Eventually, Botswana should be able to create a niche in the world economy in polished diamonds and jewelry making by developing a globally competitive industry. The specific recommendations use this goal as their starting point.

Policy recommendation #1: Accelerate training efforts

The government needs to accelerate the creation of industry-specific skills for the cutting and polishing industry. A number of countries have experimented with developing indigenous diamond beneficiation industries with little success. Botswana holds the key to attracting investors because it has its own diamond supply. Unless Botswana develops top-tier skills in diamond polishing, cutting, and jewelry making, however, investment and polishing firms will exit the country as soon as its supply of diamonds is depleted.

The development of these skills is urgent. The recently established Odi University of Science and Technology is slated to offer courses that develop these skills. In addition, the government needs to exploit its relationship with sightholders and sponsor students in cutting and polishing training programs in their factories outside the country. Industry-related skills creation should include technical skills training for the repair and service of cutting and polishing equipment, as well as apprenticeships in cutting and polishing.

Policy recommendation #2: Simplify the process for importing skilled labor

The process of importing skilled labor needs to be made less cumbersome. At a stage when Botswana needs to make a mark

in the polishing and final production of diamonds, the country cannot compromise on quality and cost effectiveness. Being a new entrant in the arena, it does not have an existing pool of labor to draw upon. Immediate skills gaps need to be filled rapidly by an international skilled labor force. At the same time, the country needs to change the negative perception of foreign workers. As shown in the input-output simulation exercise, successful beneficiation can create a large number of indirect jobs in the economy. In the short run, highly skilled foreign labor is imperative for the success of the beneficiation strategy—at least until Botswana makes a name for its polished diamond products.

Policy recommendation #3: Increase the number of accredited training programs

The Botswana Training Authority (BOTA) needs to take an active role in accrediting on-the-job training programs and ensuring the quality of other training programs. Additionally, strong linkages need to be established between Botswana's education and diamond hubs so that the demand for specific skills are transmitted to the education sector, which in turn should both strengthen the capacity of existing institutions to provide skills training and attract new training providers, both local and international. Certain partnerships with colleges in India are under discussion and should be implemented rapidly.

Policy recommendation #4: Make diamond sales more transparent

The sales of rough diamonds and the export of polished diamonds should be made more transparent. Currently, national accounts report polished diamond exports with rough diamonds exports, but local rough diamond sales are not reported. In addition, policy makers need to carefully consider allowing local rough diamond trading among the polishing and cutting factories as a way of optimizing their rough allocations.

References

- Botswana, Republic of. MoFDP (Ministry of Finance and Development Planning). 2009. National Development Plan (NDP) 10. Volumes I and II. MoFDP, Gaborone.
- . Office of the President. 2011. “President’s State of the Nation Address, November 7, 2011.” Office of the President, Gaborone.
- Kettle, P. (former Head of Beneficiation in Africa, DeBeers.) 2009. Personal interview, October 29, 2009, Gaborone.
- Leontief, W. 1985. *Input-Output Economics*. New York: Oxford University Press.
- Levhari, D., and E. Sheshiniski. 1973. “Experience and Productivity in the Israeli Diamond Industry.” *Econometrica* 41(2): 239–53.
- Mbaya, L. 2011. “Botswana – Identifying the Niche in the Global Economy.” Background paper prepared for the World Bank study, “Labor Market Signals of the Demand for Skills.” Gaborone.
- Pyatt, G., and J. Round. Eds. 1985. “Social Accounting Matrix: A Basis for Planning.” Washington, DC: The World Bank.

Appendix 1: Assumptions and Formulas of the Input-Output Simulation Model

The input-output table used for the analysis conducted for this paper is constructed based on the input-output version of Botswana's 1996–97 Social Accounting Matrix. The critical assumption is that Botswana's technical structure has not changed significantly since 1996–97 and therefore the input-output table still provides relevant information on the ratio of inputs to outputs in different sectors of the economy. The model also assumes a Leontief function for value added where value added is expressed as a fixed share of the level of output. Thus, the employment levels of different factors of production are fixed in relation to output levels, resulting in a fixed employment-output ratio assumption.

Table A1.1 Value Addition in the Diamond Pipeline

Stage of global value chain	% of original value
Producer selling value	100
Sorting and valuing	115
Cutting and polishing	127
Polished dealing	133
Jewelry manufacturing	166
Retail	320

Source: "Global Value Chains" webpage, Duke University website, Duke University, Durham, North Carolina, <http://www.duke.edu/web/soc142/team7/Diamond%20Global%20Value%20Chain.htm> (accessed September 1, 2012).

It is not possible to simply shock the economy with an exogenous change in polished diamond exports because Botswana's national accounts do not report a diamond manufacturing sector.⁴ Instead, assumptions needed to be made regarding exogenous changes in final demand associated with the production of a certain value of polished diamond exports. The following assumptions are made:

- Annual local rough diamond sales are \$550 million (3.85 billion pula)⁵
- Cutting and polishing adds 12 percent value to rough diamonds⁶
- Rough diamond purchases are 90 percent of the value of polished diamonds⁷
- Value added is \$58,858,000 (462 million pula) and total polished diamonds exports are \$549,094,000 (4.31 billion pula). Other production costs (excluding rough diamond purchases) are 10 percent of the value of polished diamonds
- Profit is 8 percent of the value added⁸
- Corporate tax is 15 percent of profits⁹

4 Polished diamond exports are aggregated with rough diamond exports in the country's national accounts.

5 These are the rough sales targets of DTCCB.

6 Based on estimates shown in table A4.1 below.

7 Estimate based on research in Botswana's cutting and polishing industry.

8 Estimate based on an interview with Peter Kettle, a former DeBeers employee with extensive experience in beneficiation in African countries.

9 The current corporate tax for the manufacturing sector in Botswana.

Tables A1.2 and A1.3 show the estimated composition of the costs of production required to produce polished diamonds, excluding the cost of purchasing rough diamonds and changes in final demand associated with the production of polished diamond exports (based on the composition of production costs and the above-cited assumptions on polished diamond production).

Table A1.2 Estimated Composition of Production Costs (excluding rough diamonds)

Labour	15%
Sight brokers	3%
Security	5%
Catering	0.5%
Manufactured inputs	25%
Servicing of equipment	8%
Water and electricity	3.5%
Telecommunications	2%
Buildings and land	3%
Gem certification	20%
Transport	5%
Insurance	10%

Source: Mbaya (2011).

Table A1.3 Estimated Changes in Final Demand

Sector	Pula (P) Millions
Mining	3.850
Rough Diamonds	3.850
Government	5.544
Corporate Tax	5.544
Households	62.9244
Labour	62.9244
Banking, Insurance & Business Services	192.96816
Sight Brokers	12.58488
Gem Certification	83.8992
Security	20.9748
Insurance	41.9496
Equipment Servicing	33.55968
Transport, Post & Telecommunications	29.36472
Transport	20.9748
Telecommunication	8.38992
Water and Electricity	14.68236
Retail Trade, Hotel, Restaurants	2.09748
Catering	2.09748
Manufacturing	104.874
Manufactured Inputs	104.874

Source: Mbaya (2011).

The increase in final demand for rough diamonds from the mining sector is not included in the simulation because the activities of the cutting and polishing industry do not result in an increase in mining production. Including rough diamonds in the change in final demand would simply result in double counting. The simulation is on the production side of the

economy and does not take the changes in final demand from households into account. Although households are exogenous in the model, it goes without saying that the employment created in the cutting and polishing industries will increase household consumption, which will ripple throughout the economy, resulting in multiplier effects.

Formulas

Using matrix algebra, the changes in output and employment are calculated using the following formulas:

Change in output: $\Delta X = (I - A)^{-1}F$

where ΔX is the change in output vector, F is the final demand vector, $(I - A)^{-1}$ is the Leontief Inverse, I is the identity matrix, and A is the coefficient matrix

Change in employment: $\Delta E = \frac{E}{X} (I - A)^{-1}F$

where ΔE is the change in employment vector and $\frac{E}{X}$ is the employment-output ratio/coefficient.

Appendix 2: Detailed Simulation Results—Change in Employment by Sector and Across Sectors

Table A.2.1 Input-Output Table

Industry		1	2	3	4	5	6	7	8	9	10	11	Intermediate Demand	Final Demand (Y)	Total Supply (X)	
		Agriculture	1	42.03	1.52	270.10	0.04	0.00	0.33	0.02	0.06	0.08	149.71	2.50	466.4	354.62
Mining	2	0.01	0.70	0.86	26.09	13.75	0.05	0.00	0.87	0.02	1.30	0.00	43.7	7,576.23	7,619.9	
Manufacturing	3	44.18	97.05	463.51	13.19	122.29	34.43	80.37	15.77	10.86	338.01	33.38	1,253.1	2,397.12	3,650.2	
Water and Electricity	4	3.70	122.57	32.47	22.36	21.75	38.02	6.76	16.65	0.99	71.15	13.07	349.5	107.11	456.6	
Construction	5	2.54	14.80	11.58	2.37	813.40	45.20	22.59	20.02	5.94	104.50	8.94	1,051.9	2,173.20	3,225.1	
Trade, Hotels and Restaurants	6	1.23	6.76	14.45	5.62	37.51	28.93	11.13	22.27	0.87	108.10	8.47	245.3	285.59	530.9	
Transport, Post & Telecommunications	7	10.34	47.42	51.79	6.70	60.26	175.56	17.15	42.07	3.70	327.75	28.81	771.5	330.88	1,102.4	
Banking, Insurance & Business Services	8	4.86	40.59	49.90	12.71	50.63	204.56	30.11	43.52	9.74	131.85	27.15	605.6	708.59	1,314.2	
Other	9	0.00	82.89	0.00	0.14	0.00	0.00	0.00	0.00	1.91	14.58	0.00	99.5	315.18	414.7	
General Government	10	0.01	1.06	0.01	0.00	0.00	0.00	0.00	0.00	0.00	8.15	0.57	9.8	4,842.66	4,852.5	
Social and Personal Services	11	8.30	4.77	25.83	5.47	70.78	9.31	68.62	13.96	3.29	15.88	43.29	269.5	772.53	1,042.0	
Labour Value Added	F1	5.51	41.82	38.77	14.12	40.79	47.03	20.26	37.95	37.95	200.80	28.75	5,165.8	19,863.72	25,029.5	
	F2	0.81	10.86	10.73	2.25	17.52	17.71	10.96	17.66	17.66	23.92	39.24				
	F3	1.15	8.73	8.09	2.95	8.51	9.81	4.23	4.23	7.92	41.90	6.00				
	F4	0.17	2.27	2.24	0.47	3.66	3.70	2.29	2.29	3.69	4.99	8.19				
	F5	3.35	25.40	23.55	8.58	24.77	28.56	12.30	12.30	23.05	23.05	121.94	17.46			
	F6	0.49	6.59	6.52	1.37	10.64	10.76	6.65	6.65	10.73	10.73	14.53	23.83			
	F7	17.40	132.03	122.40	44.58	128.77	148.47	63.94	63.94	119.82	119.82	633.88	90.77			
	F8	2.55	34.27	33.89	7.12	55.32	55.92	34.59	34.59	55.76	55.76	75.51	123.86			
	F9	15.37	116.61	108.11	39.38	113.73	131.13	56.47	56.47	105.82	105.82	559.84	80.17			
	F10	406.71	0.00	37.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.72			
Gross Capital Formation	F11	120.51	6216.51	381.33	24.76	541.42	1235.53	69.30	875.42	875.42	0.00	208.35				
	F12	27.68	312.60	130.50	170.94	79.94	97.85	295.10	200.52	200.52	801.18	46.47				
Government	F13	12.31	42.53	224.05	7.51	141.27	38.55	37.23	24.17	24.17	152.19	23.75				
	F14	2.33	2.26	16.69	0.00	1.40	0.98	2.67	0.83	0.83	0.00	0.57				
	F15	-2.41	-0.06	-32.79	-0.04	-9.18	-2.90	0.00	0.00	-29.06	-29.06	0.00	-1.55			
Other Countries	I8	50.28	168.12	1353.45	22.27	632.57	96.02	194.55		118.52	685.64	118.63				

Table A.2.2 Coefficient Matrix (A)

	1	2	3	4	5	6	7	8	9	10	11
Agriculture	0.05	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00
Mining	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manufacturing	0.05	0.01	0.13	0.03	0.04	0.06	0.07	0.01	0.03	0.07	0.03
Water and Electricity	0.00	0.02	0.01	0.05	0.01	0.07	0.01	0.01	0.00	0.01	0.01
Construction	0.00	0.00	0.00	0.01	0.25	0.09	0.02	0.02	0.01	0.02	0.01
Wholesale/Retail Trade, Hotels and Restaurants	0.00	0.00	0.00	0.01	0.01	0.05	0.01	0.02	0.00	0.02	0.01
Transport, Post & Telecommunications	0.01	0.01	0.01	0.01	0.02	0.33	0.02	0.03	0.01	0.07	0.03
Banking, Insurance & Business Services	0.01	0.01	0.01	0.03	0.02	0.39	0.03	0.03	0.02	0.03	0.03
Other	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
General Government	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Social and Personal Services	0.01	0.00	0.01	0.01	0.02	0.02	0.06	0.01	0.01	0.00	0.04
Prof. & Tech Employees – Cit.	0.01	0.01	0.01	0.03	0.01	0.09	0.02	0.03	0.09	0.04	0.03
Prof. & Tech. Employees – Non-Cit.	0.00	0.00	0.00	0.00	0.01	0.03	0.01	0.01	0.04	0.00	0.04
Admin. & Mang. Employees – Cit.	0.00	0.00	0.00	0.01	0.00	0.02	0.00	0.01	0.02	0.01	0.01
Admin. & Mang. Employees – Non-Cit.	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.01
Clerical Employees – Cit.	0.00	0.00	0.01	0.02	0.01	0.05	0.01	0.02	0.06	0.03	0.02
Clerical Employees – Non-Cit.	0.00	0.00	0.00	0.00	0.00	0.02	0.01	0.01	0.03	0.00	0.02
Skilled Manual – Cit.	0.02	0.02	0.03	0.10	0.04	0.28	0.06	0.09	0.29	0.13	0.09
Skilled Manual – Non-Cit.	0.00	0.00	0.01	0.02	0.02	0.11	0.03	0.04	0.13	0.02	0.12
Unskilled Employees	0.02	0.02	0.03	0.09	0.04	0.25	0.05	0.08	0.26	0.12	0.08
Mixed Income	0.50	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
Net Operating Surplus	0.15	0.82	0.10	0.05	0.17	2.33	0.06	0.67	2.11	0.00	0.20
Depreciation	0.03	0.04	0.04	0.37	0.02	0.18	0.27	0.15	0.48	0.17	0.04
Taxes on Products	0.01	0.01	0.06	0.02	0.04	0.07	0.03	0.02	0.06	0.03	0.02
Taxes on Production	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subsidies	0.00	0.00	-0.01	0.00	0.00	-0.01	0.00	-0.02	-0.07	0.00	0.00
Imports	0.06	0.02	0.37	0.05	0.20	0.18	0.18	0	0.29	0.14	0.11

Table A.2.3 Leontief Inverse $(I - A)^{-1}$

		1	2	3	4	5	6	7	8	9	10	11
Agriculture	1	1.059	0.002	0.090	0.003	0.005	0.011	0.007	0.002	0.003	0.040	0.006
Mining	2	0.000	1.001	0.001	0.060	0.006	0.006	0.001	0.002	0.000	0.002	0.001
Manufacturing	3	0.068	0.017	1.155	0.041	0.065	0.130	0.092	0.022	0.033	0.095	0.044
Water and Electricity	4	0.006	0.017	0.012	1.055	0.013	0.092	0.010	0.016	0.004	0.020	0.016
Construction	5	0.006	0.004	0.007	0.011	1.342	0.144	0.032	0.025	0.021	0.036	0.015
Wholesale/Retail Trade, Hotels and Restaurants	6	0.003	0.002	0.006	0.015	0.018	1.074	0.013	0.020	0.003	0.027	0.011
Transport, Post & Telecommunications	7	0.016	0.008	0.021	0.024	0.035	0.383	1.026	0.042	0.012	0.082	0.035
Banking, Insurance & Business Services	8	0.010	0.007	0.021	0.039	0.032	0.447	0.038	1.045	0.027	0.044	0.035
Other	9	0.000	0.011	0.000	0.001	0.000	0.000	0.000	0.000	1.005	0.003	0.000
General Government	10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.002	0.001
Social and Personal Services	11	0.013	0.002	0.012	0.016	0.034	0.055	0.069	0.016	0.010	0.012	1.047

Table A.2.4 Change in Output

		Change in Final Demand (P 000)	Change in Output	Percentage Change in Output
Agriculture	1	0	10.31	1.26%
Mining	2	0	1.37	0.02%
Manufacturing	3	104.894	129.40	3.54%
Water and Electricity	4	14.68236	20.53	4.50%
Construction	5	0	7.19	0.22%
Wholesale/Retail Trade, Hotels and Restaurants	6	2.09748	7.48	1.41%
Transport, Post & Telecommunications	7	29.36472	42.08	3.82%
Banking, Insurance & Business Services	8	192.96816	206.69	15.73%
Other	9	0	0.04	0.01%
General Government	10	5.544	5.56	0.11%
Social and Personal Services	11	0	6.67	0.64%
		349.55072	437.30	1.75%

Table A.2.5 Overall Employment Change across all Sectors

Initial Employment	345405
Increase in Employment	6035
Percentage Change	1.7%

Source: From previous estimates.

Table A.2.6 Indirect Employment Effects by Skills in all the Sectors

	Increase in Labour Value Added (P millions)	Increase in Employment	% of Increase
Prof. & Tech Employees – Cit.	10.00	572	9%
Prof. & Tech. Employees – Non-Cit.	4.26	244	4%
Admin. & Mang. Employees – Cit.	2.09	119	2%
Admin. & Mang. Employees – Non-Cit.	0.89	51	1%
Clerical Employees – Cit.	6.07	348	6%
Clerical Employees – Non-Cit.	2.59	148	2%
Skilled Manual – Cit.	31.57	1807	30%
Skilled Manual – Non-Cit.	13.44	770	13%
Unskilled Employees	27.88	1596	26%
Mixed Income	6.62	379	6%
Total	105.40	6035	100%

Table A.2.7 Overall Employment Change in Banking, Insurance, and Business Services Sector

Initial Employment	11737
Increase in Employment	1846
Percentage Change	15.73%

Table A.2.8 Indirect Employment Effects by Skills in Banking, Insurance, and Business Services

	Increase in Labour Value Added (P millions)	Increase in Employment	% of Increase
Prof. & Tech Employees – Cit.	5.97	183	10%
Prof. & Tech. Employees – Non-Cit.	2.78	85	5%
Admin. & Mang. Employees – Cit.	1.25	38	2%
Admin. & Mang. Employees – Non-Cit.	0.58	18	1%
Clerical Employees – Cit.	3.63	111	6%
Clerical Employees – Non-Cit.	1.69	52	3%
Skilled Manual – Cit.	18.84	578	31%
Skilled Manual – Non-Cit.	8.77	269	15%
Unskilled Employees	16.64	511	28%
Mixed Income	0.00	0	0%
Total	60.14	1846	100%

Table A.2.9 Overall Employment Change in Manufacturing Sector

Initial Employment	29530
Increase in Employment	1047
Percentage Change	3.54%

Table A.2.10 Indirect Employment Effects by Skills in Manufacturing Sector

	Increase in Labour Value Added (P millions)	Increase in Employment	% of Increase
Prof. & Tech Employees – Cit.	1.37	103	10%
Prof. & Tech. Employees – Non-Cit.	0.38	29	3%
Admin. & Mang. Employees – Cit.	0.29	22	2%
Admin. & Mang. Employees – Non-Cit.	0.08	6	1%
Clerical Employees – Cit.	0.83	63	6%
Clerical Employees – Non-Cit.	0.23	17	2%
Skilled Manual – Cit.	4.34	327	31%
Skilled Manual – Non-Cit.	1.20	90	9%
Unskilled Employees	3.83	288	28%
Mixed Income	1.35	101	10%
Total	13.91	1047	100%

Table A.2.11 Overall Employment Change in Transport and Communication Sector

Initial Employment	7700
Increase in Employment	294
Percentage Change	3.82%

Table A.2.12 Indirect Employment Effects by Skills in Transport and Communication Sector

	Increase in Labour Value Added (P millions)	Increase in Employment	% of Increase
Prof. & Tech Employees – Cit.	0.77	28	10%
Prof. & Tech. Employees – Non-Cit.	0.42	15	5%
Admin. & Mang. Employees – Cit.	0.16	6	2%
Admin. & Mang. Employees – Non-Cit.	0.09	3	1%
Clerical Employees – Cit.	0.47	17	6%
Clerical Employees – Non-Cit.	0.25	9	3%
Skilled Manual – Cit.	2.44	89	30%
Skilled Manual – Non-Cit.	1.32	48	16%
Unskilled Employees	2.16	78	27%
Mixed Income	0.00	0	0%
Total	8.08	294	100%

Table A.2.13 Overall Employment Change in Water and Electricity Sector

Initial Employment	2805
Increase in Employment	126
Percentage Change	4.50%

Table A.2.14 Indirect Employment Effects by Skills in Water and Electricity

	Increase in Labour Value Added (P millions)	Increase in Employment	% of Increase
Prof. & Tech Employees – Cit.	0.64	15	12%
Prof. & Tech. Employees – Non-Cit.	0.10	2	2%
Admin. & Mang. Employees – Cit.	0.13	3	2%
Admin. & Mang. Employees – Non-Cit.	0.02	0	0%
Clerical Employees – Cit.	0.39	9	7%
Clerical Employees – Non-Cit.	0.06	1	1%
Skilled Manual – Cit.	2.00	47	37%
Skilled Manual – Non-Cit.	0.32	7	6%
Unskilled Employees	1.77	41	33%
Mixed Income	0.00	0	0%
Total	5.43	126	100%

Table A.2.15 Overall Employment Change in Wholesale/Retail Trade, Hotel, and Restaurant Sector

Initial Employment	54156
Increase in Employment	762
Percentage Change	1.41%

Table A.2.16 Indirect Employment Effects in by Skills in Wholesale/Retail Trade, Hotel, and Restaurant Sector

	Increase in Labour Value Added (P millions)	Increase in Employment	% of Increase
Prof. & Tech Employees – Cit.	0.66	79	10%
Prof. & Tech. Employees – Non-Cit.	0.25	30	4%
Admin. & Mang. Employees – Cit.	0.14	17	2%
Admin. & Mang. Employees – Non-Cit.	0.05	6	1%
Clerical Employees – Cit.	0.40	48	6%
Clerical Employees – Non-Cit.	0.15	18	2%
Skilled Manual – Cit.	2.09	250	33%
Skilled Manual – Non-Cit.	0.79	94	12%
Unskilled Employees	1.85	221	29%
Mixed Income	0.00	0	0%
Total	6.38	762	100%

Table A.2.17 Overall Employment Change in Agriculture Sector

Initial Employment	2805
Increase in Employment	35
Percentage Change	1.23%

Table A.2.18 Indirect Employment Effects by Skills in Agriculture

	Increase in Labour Value Added (P millions)	Increase in Employment	% of Increase
Prof. & Tech Employees – Cit.	0.64	4	12%
Prof. & Tech. Employees – Non-Cit.	0.10	1	2%
Admin. & Mang. Employees – Cit.	0.13	1	2%
Admin. & Mang. Employees – Non-Cit.	0.02	0	0%
Clerical Employees – Citizens	0.39	2	7%
Clerical Employees – Non-Cit.	0.06	0	1%
Skilled Manual – Citizens	2.00	13	37%
Skilled Manual – Non-Cit.	0.32	2	6%
Unskilled Employees	1.77	11	33%
Mixed Income	0.00	0	0%
Total	5.43	35	100%