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Economic and Trade Impact of the Matarbari DSP Project

1. Introduction

Bangladesh is constructing its first deep-sea port (DSP) at Matarbari in an effort to alleviate pressure on the nation's biggest seaport, Chattogram Seaport, and promote international trade by reducing the cost of cargo handling. This DSP is coming up in Dhalghata, Mahshkhali Upazila (Hossan, 2022). The port is modeled after the Japanese ports of Kashima and Niigata[1]. The deep-sea port will become the region's most significant export-import hub, allowing mother ships with a draft greater than 16 meters to berth, compared to Chattogram Port's 9.5 meters. It is anticipated to contribute 2 per cent to 3 per cent to the nation's gross domestic product (GDP).[2]

The construction of the port project started in 2020 with development assistance of the JICA.[3] To start with, the project includes construction of two 600 MW power plants, a deep-sea port terminal, and a 14.5 km long port channel. Eventually, the facility will become a multipurpose deep-sea port (Barua, 2018). In addition, the port will feature two distinct terminals: a multipurpose terminal and a container terminal as well as the construction of 26.7 km of link roads. The Chattogram Port Authority (CPA) and the Ministry of Shipping's Roads and Infrastructure Division have been implementing the project, which is likely to be completed by December 2026. Upon completion, the Matarbari Port Development Project will serve as a commercial hub and the ships with the ability to transport 8,000 to 10,000 containers will be able to dock at the port (CPA News, 2020).

According to a study by JICA, the simulation model predicts that demand for container cargo at Chattogram Port will increase to 6.9 million TEUs in 2041, while it will reach 550,000 TEUs at Payra Port and 2.6 million TEUs at Matarbari Port (JICA, 2018). In the fiscal year 2021-22, Chattogram port alone handled approximately 3.2 million TEUs containers, and the annual container handling volume in the country is expected to reach 14 million TEUs by 2041. In addition, the Matarbari terminal will save approximately US$ 131 per TEU and US$ 200 per FEU, according to the above JICA study. It is anticipated that the proposed Matarbari Port will serve as the gateway not only for domestic and international freight transport but also for the import of materials required for the proposed power plants. To ensure efficient road freight transportation, international corridors established by international agreements must be taken into account. Bangladesh is anticipated to serve as the gateway to the hinterland countries along the freight transport route. It is essential that Matarbari Port shall be connected to N1 (AH41) and Chattogram to N1 (AH41) via Matarbari Port (JICA, 2018).

The fourth port in Bangladesh (Matarbari) will increase the country's capacity to handle cargo and satisfy the rising demand for trade activities.[4] The ports of Bangladesh manage approximately US$ 60 billion worth of imports and exports annually, with annual ship arrivals increasing by more than 11 per cent. However, the shallow depth and narrow width of the Karnaphuli river channel restrict the size of ships that can anchor at the Chattogram port jetty. The construction of a deeper port capable of accommodating larger vessels could reduce transportation costs by 15 per cent and stimulate new investment and development in the country (CPA News, 2020). The seaports of Bangladesh can provide access to the sea for landlocked nations like Nepal and Bhutan, as well as India's Northeast region. Matarbari is anticipated to become Bangladesh's and South Asia's commercial hub.

2. Research Objectives

The overall objective is to estimate the economic and the trade impact of Matarbari DSP Project, and the specific objectives are as follows:

- Estimating the impact of investment in the Matarbari DSP Project on output and employment;
- Estimating the impact of export through the Matarbari DSP Project on output and employment;
- Understanding changes in sector-wise share of output due to investment in and export through the Matarbari DSP; and
- Understanding changes in labour across skill and location due to investment in and export through the Matarbari DSP.

3. Methodology

Four interconnected components of an integrated, economy-wide modeling system were utilized for this study. First, the level of Matarbari project-specific investment amounts, export growth (assumption), and employment has been determined through secondary sources (i.e., the Ministry of Planning and LFS). Second, a well-recognized economy-wide model (i.e., social accounting model) was used to evaluate the economy-wide impacts of Matarbari Project investments as well as the trade impact of an export increase. Using the microdata from the 2016–17 LFS, a matrix encompassing gender, skills, and locations has been built. To assess the overall employment impacts of the Matarbari Project, a model was developed that integrated the investment and export modules into the SAM-employment integrated model.

3.1 The Investment Shock Simulation of the Matarbari DSP Project

In a social accounting matrix (SAM) framework, "investment shock" often refers to a change in the level of investment in a certain sector or industry and the consequent effects on the rest of the economy. In a SAM, investment is recorded as a flow of capital from households, governments, and foreign sources to various industries, which then purchase inputs and produce outputs. The investment in this study refers to the funds injected into the project by the JICA, CPA, and the Bangladesh government.

When there is a positive investment shock, indicating an increase in investment in a particular industry or sector, the effects can be observed in other sectors of the economy through inter-industry transactions recorded in the SAM. For instance, an increase in construction sector investment might lead to an increase in demand for inputs from other sectors, including transportation, raw materials, and financial services. This higher demand for inputs can lead to more sales and production in those industries, which is good for the economy as a whole.

In a SAM, input-output analysis or computable general equilibrium models can be used to assess the consequences of an investment shock on production, consumption, employment, and other key macroeconomic indicators. The severity of the impact will depend on the scale of the investment shock, the type of industry or sector in which the investment takes place, and the interdependence of that sector with other sectors of the economy.

Magnitude of Investment Shock in the SAM

Based on secondary sources (the Ministry of Planning), the study has discovered a significant investment shock in the Matarbari project. The project is still under construction. In Bangladesh, however, the Executive Committee of the National Economic Council (ECNEC) has approved the Matarbari DSP project at a cost of Tk 17,777.16 crores. Considering completion of the project is anticipated in December 2026, the sum will be spent between 2020 and 2026.

3.2 The Export Shock Simulation after Construction of the Matarbari DSP

In a social accounting matrix (SAM), an export shock is a sudden change in the number or value of exports made by a certain sector or industry in an economy.

An export shock can have a substantial effect on a country's economy as it affects production, employment, and income creation in the impacted industries. An increase in exports, for instance, might result in a rise in output, which in turn generates more employment possibilities and higher wages for workers in that industry. In addition, a boost in exports might result in an influx of foreign currency, which can have favorable implications for a country's balance of payments and economic growth as a whole.

A SAM allows for the modeling of export shocks by altering the export values or volumes of the affected sector or industry. This can contribute to the analysis of the direct and indirect consequences of the export shock on the economy and the identification of viable policy actions to minimize its negative effects.

Magnitude of Export Shock in the SAM

According to the Perspective Plan of Bangladesh (2021–2041), Bangladesh's exports will expand between 2026 and 2030. We expect that the development of the Matarbari DSP will contribute significantly to the increase in exports. The study assumes

that the Matarbari DSP will account for 25 per cent of the total export growth. Thus, the higher quantity is regarded as the exogenous shock within the framework of the social accounting matrix framework.

3.3 Economic Assessment Model

For this study, the social accounting matrix (SAM) multiplier analysis is an effective tool. It has been developed as a practical tool that can be implemented with minimal data and programming constraints for a large number of projects in different nations. The method is accompanied by a variety of restrictions and presumptions, which are detailed in Annexure 1. The Bangladesh Bridges Authority (BBA) used a similar approach based on the Social Accounting Matrix (SAM) methodology to estimate the impact of the Padma Bridge, the Bangladesh Atomic Energy Commission (BAEC) adopted a similar methodology to assess the feasibility of the Rooppur Nuclear Power Plant, and the Bangladesh Planning Commission used a similar methodology to assess sectoral GDP impacts under the five-year plans. In light of this, the SAM model was utilized to predict the economic and trade effects of investing in the Matarbari DSP project.

3.4 Social Accounting Matrix (SAM)

Table 1 presents the basic structure of a SAM. The input-output part (Annexure 2) of SAM captures production linkages across sectors.

The backward and forward links are governed by the production technologies of the respective industries. The multiplier is greater with stronger linkages. The backward linkages are supported by industry's increased demand for inputs to produce extra goods and services. The stronger a sector's backward linkages, the more input-intensive the sector's production technology (downstream industries). Forward linkages are responsible for the increasing input supply to upstream businesses. Consequently, the importance of a sector to upstream industries will determine the strength of its forward linkages. It should be noted that the development of the Matarbari DSP project will have substantial forward and backward linkages.

SAM-based Multiplier Framework

The transition from a SAM data framework to a SAM model (also known as a multiplier framework) necessitates the separation of exogenous and endogenous SAM accounts. In general, accounts that are intended to be used as policy instruments (such as government expenditure, investment, and exports) are made exogenous, whereas accounts that are specified as objectives or targets (such as output, commodity demand, factor return, and household income or expenditure) must be made endogenous. For each injection into the exogenous accounts of the SAM, the interdependent SAM system sends a signal to the endogenous accounts.

By altering the exogenous injection vectors, the macroeconomic effects of investing in the Matarbari DSP Project and the increase in exports due to the same cause have been investigated. The intervention produces additional outputs in intervention sectors, often known as a "direct effect." The sum of all these outputs from linked sectors is referred to as the "indirect effect." The intervention also generates additional outputs for all other sectors; the sum of these outputs is known as the "induced" impact. The intervention's entire impact is made up of direct, indirect, and induced impacts (Figure 3).

Due to the interconnected nature of the system, the incomes of factors, households, and production are all derived from external

Figure 1: Basic Structure of a Social Accounting Matrix (SAM)

SAM Accounts	Production Account			Institution Account					
				Current Accounts				Capital Accounts	
	Activity	Commodity	Factor	Household	Government	Enterprise	RoW		Total
Activity (AC)		Domestic output							Total Activity Use
Commodity (CM)	Input-output			Private Consumption	Public Consumption		Exports	Investment	Total Commodity Use
Factor (FP)	Distribution of value added								Total Factor Income
Household (HH)			Redistribution of value added (labour and capital)	Inter-Household Transfers	Government Transfers	Enterprise Transfers	Remittances		Total Household Income
Government (GoV)	Value added Tax	Indirect Tax (Production and Import)	Redistribution of capital value added	Income Tax		Corporation Tax			Total Government Income
Enterprise (ENT)			Redistribution of capital value added						Total Enterprise Income
Rest of the World (RoW)		Intermediate Imports		Imports of Consumption Goods				Imports of Capital Goods	Total RoW Payments
Capital (CAP)				Household Savings	Government Savings	Enterprise Savings	Foreign Savings	Flow of Funds	Total Savings
Total Supply (TSS)	Domestic Output	Commodity Supply	Payments of Factors of Production	Outlays by Household	Outlays by Government	Outlays by Enterprises	RoW Receipts	Investment	

Note: R = rows and C = columns.

injections into the economy through a multiplier process. This paper develops the multiplier process on the premise that when an endogenous income account receives an exogenous expenditure injection, it spends it in the same proportions as reflected in the matrix of average propensities to spend (APS). The APS matrix elements are computed by dividing each cell by the sum of its associated column (Annexure 3).

3.5 Employment Matrix

For the purpose of estimating the impact of employment, a matrix of employment has been developed and integrated into the SAM multiplier model. In this regard, the population aged 15 and older has been factored into the labor force. Hence, the employment matrix was utilized to capture the employment context per activity. The employment matrix's structures have been designed according to the following categories:

Classification by location

Classification by location has been used to determine the distribution of labor patterns across the economy as a whole. This classification examines the distribution of labor for each activity from both urban and rural viewpoints.

Classification by gender

The gender classification of total labor has been completed across all activities. The goal of this classification is to highlight gender-specific differences in occupational patterns.

Figure 2: SAM Multiplier Model Specification in a Matrix Format

		Activity					Factors		Institution				Total Use
		A1	...	...	...	A100	LAB	CAP	HH	GoV	SAV	RoW	
Commodity	C1	Endogenous [Multiplier)								Exogenous			
	..												
	..												
	..												
	C100												
Factor	Labour												
	Capital												
Institution	Household												
	Government)	Leakage								Other			
	Savings												
	Rest of the world												
	Total Supply												

Source: Authors' specification

Classification by skills

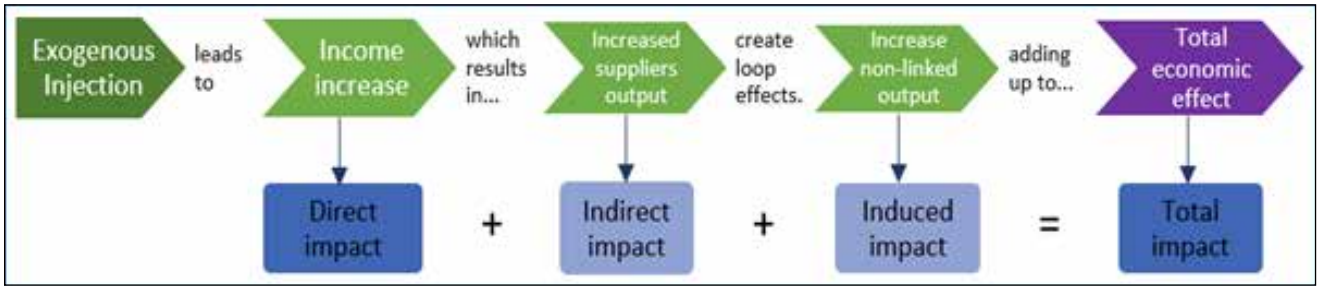
In addition to location and gender categorization, skills classification has been performed to reveal the labor distribution pattern based on the skills of individuals across activities. The conditions stated in Tables 1 and 2 establish the classification of three types of skill sets. The classification of skills without training is shown in Table 2. The classification of skills with training is shown in Table 1.

Training[5] has been regarded as the most important factor in classifying individuals aged 15 or older into the three skill categories (i.e., low, medium, and high). For example, a person with schooling between the 6th and 12th grades but no training has been classified as medium-skilled labor. In contrast, another individual with the same educational background who obtained further training has been classified as highly skilled labor. Furthermore, individuals who have completed their HSC and beyond (i.e., further education) are considered highly skilled workers regardless of their training.

3.6 Construction of Employment Matrix

Following the completion of the classification of labor factors across location, gender, and

Figure 3: The Process of Multiplier Impact



Source: Authors' specification.

Table 1: Classification of Skills without Training

Without Training	
Skills	**Education**
Low	0-5th
Medium	6th-12th
High	HSC onwards

Note: Education refers to years of schooling.

Source: Authors' specification

Table 2: Classification of Skills with Training

With Training	
Skills	**Education**
Low	No Education
Medium	0-5th
High	6th-12th

Source: Authors' specification

skills, the LFS 2016–17 sectoral activity list has been compiled. On the basis of both labor factor and sectoral activity classifications, a matrix depicting the allocation of labor among activities has been developed (Table 3). This study distinguishes 83 activities by region (rural versus urban), gender (male versus female), and skill classification (low-medium-high). And the employment coefficient of an activity for a labor class is calculated by dividing the amount of labor utilized in an activity by the total labor supply of the labor class. For example, the employment coefficient is computed as follows for activity 1 and low-skilled males from the labor class in rural areas: $\varepsilon_1=(A_1/T_1)$

3.7 Integrated Model

The integrated model (Figure 4) comprises three distinct components. The first component consists of investment information for the Matarbari Development Project. The component also comprises the amount of the exogenously assumed export shock. The second component, the macro-model, consists of the Bangladesh SAM multiplier model, which investigates sectoral GDP and household income for the entire economy. The final component was produced based on the employment matrix, which was then combined with the Macro model to determine the employment impact. Using this integrated model, the study employed two simulations (an investment simulation and an export simulation) to determine the employment effects of the Matarbari Development Project. Multiplying the employment coefficient (from the third component) by the change in activity output is how the employment impact is determined during the simulation phase (from the second component).

3.8 Employment Impacts of Investment in Matarbari Development Project

This section describes the employment impacts of the Matarbari Project's investment. The employment effect has been separated into two categories: investment impact

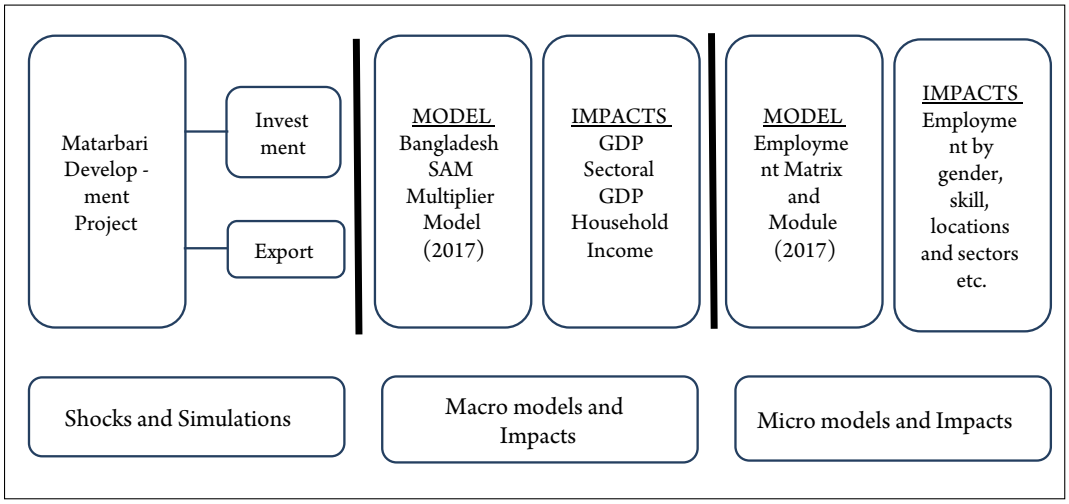
Table 3: Structure of Employment Matrix

Activity	Labour												Total
	R						U						
	LS		MS		HS		LS		MS		HS		
	M	F	M	F	M	F	M	F	M	F	M	F	
1	A_1												
2													
3													
…													
…													
…													
…													
82													
Total	T_1												

Region: R – Rural and U – Urban; Skill: LS – Low Skill, MS – Medium Skill and HS – High Skill; and Gender: M – Male and F – Female

Source: Authors' specification

Table 4: Structure of Integrated Model



Source: Authors' specification

and export growth impact. The multiplier SAM model was utilized to quantify the employment impacts of the two simulations conducted for this study. By connecting the numerous economic sectors and actors, the SAM multiplier model can capture the impacts of any exogenous event on the entire economy. Thus, using the model to predict the possible number of jobs to be created in high-productivity and diverse industrial sectors, an ex-ante calculation of multiple injections (namely, investments in the Matarbari Project and export increases due to the Matarbari Port) was undertaken.

However, the SAM multiplier model does not directly provide employment scenarios; rather, it provides output (production) scenarios. So, the study used Bangladesh's sectoral employment coefficient to find a link between changes in output caused by any external shock and changes in employment.

Bangladesh SAM: SAM 2017, the most recent SAM available for Bangladesh, was used in this study. The SAM 2017 system contains

219 accounts. The following is a breakdown of 219 accounts: (i) 100 activities; (ii) 100 goods; (iii) inputs of production (labor and capital); and (iv) eight household categories (Annexure 4).

Employment Matrix: Utilizing LFS 2016–17, the study was able to classify industry into 82 categories in accordance with SAM's sector classification. So, when looking at the impacts on employment, the SAM's 100 activities are cut down to 82 based on the employment matrix's list of sectors.

Base employment data: The LFS 2016–17, Bangladesh's most recent labor force survey, was used to get the base employment statistics for each sector. These statistics were broken down by locations, gender, skills, and job status.

4. Impact on Domestic Output

4.1 Case 1: Investment Simulation

Simulation Design: To run the investment simulation exercise, the investment figure from the ministry of planning was injected into the exogenous investment account, and changes in output and employment were observed.

The impact of the investment on the four endogenous accounts (output, commodity demand, value-added, and household consumption) for the Matarbari Development Project in terms of change over base value can be illustrated through the SAM simulation (Table 5). Compared to the base value, output for the Matarbari DSP project is set to rise by 1.81 per cent in 2026. The investment in the Matarbari project has the potential to generate a total of US$ 6,163 million.

For the Matarbari DSP project investment, the effects on output can be broken down across agriculture, industry, and services (Table 6). Overall, the effect on agricultural, industrial, and service output is estimated to be worth US$ 926 million, US$ 3,208 million, and US$ 2,030 million, respectively. The total impact is US$ 6,163 million.

The SAM result shows that more than half of the activity output will be generated in the industry sector (52.1 per cent of the economy). The agriculture and service sectors will generate 15 per cent and 32.9 per cent of the activity output, respectively (Table 6).

4.2 Case 2: Export Simulation

Simulation Design: To run the export simulation exercise, the assumed increase in export figure (25 per cent of total export is assumed to increase due to the Matarbari DSP) was injected into the exogenous Rest

Table 5: Investment Simulation Impact on Domestic Output

Areas	Endogenous Account	Base Value (US$ Million)	Value after Simulation (US$ Million)	Change over Base	Percentage Change over Base
Matarbari Project Investment (2020-2026)	Activity Output	340,823	346,986	6,163	1.81
	Commodity Demand	390,161	397,044	6,883	1.76
	Value Added	174,759	177,666	2,907	1.66
	Household Consumption	162,562	165,042	2,480	1.53

Source: Authors' compilation based on SAM Multiplier-based simulation results

> The completion of the Matarbari DSP will contribute to a 6.83 per cent increase in output in Bangladesh due to increased exports between 2026 and 2030. The increased share of exports has the potential to raise activity output by US$ 23,264 million.

Table 6: Investment Simulation Impact on Domestic Output by Economic Sector

	Broad Sectors	Activity Output (Millions US$)	Activity Output (per cent of the economy)
Matarbari Project Investment (2020-2026)	Agriculture	926	15.0
	Industry	3,208	52.1
	Services	2,030	32.9
	Total	6,163	100.0

Source: Authors' compilation based on SAM Multiplier-based simulation results

of the world (RoW) account, and changes in output and employment were observed.

The SAM export simulation (Table 7) shows how the growth in exports between 2026 and 2030—which is assumed to be through the Matarbari DSP—changes the four endogenous accounts (production, commodity demand, value added, and household consumption). The completion of the Matarbari DSP will contribute to a 6.83 per cent increase in output in Bangladesh due to increased exports between 2026 and 2030. The increased share of exports has the potential to raise activity output by US$ 23,264 million.

The SAM results show that the total output of all the activities will add up to US$ 23,264.11 million. The industry sector (47.03 per cent of the economy) will dominate activity output generation, followed respectively by the service sector and agriculture sector (Table 8).

5. Impact on Employment

For the first simulation (the investment simulation), the investments in Matarbari have the potential to generate a total of 0.935 million jobs. These estimates are for the years 2020 to 2026, so about 0.133 million jobs will

Table 7: Export Simulation Impact on Domestic Output

Areas	Endogenous Account	Base Value (US$ Million)	Value after Simulation (US$ Million)	Change over Base	Percentage Change over Base
Export Shock Due to Matarbari Port (2026-2030)	Activity Output	340,823	364,087	23,264	6.83
	Commodity Demand	390,161	416,428	26,267	6.73
	Value Added	174,759	187,109	12,350	7.07
	Household Consumption	162,562	173,159	10,597	6.52

Source: Authors' compilation based on SAM Multiplier-based simulation results

Table 8: Export Simulation Impact on Domestic Output by Economic Sector

Areas	Board Sector	Activity Output (US$ Million)	Activity Output (per cent of the Economy)
Export Shock Due to Matarbari Port (2026-2030)	Agriculture	3740.26	16.08
	Industry	10941.56	47.03
	Services	8582.27	36.89
	Total	23264.11	100

Source: Authors' compilation based on SAM Multiplier-based simulation results

be created each (Table 9). On the other hand, the increase in exports due to the Matarbari DSP will lead to 4.60 million jobs in the period of 2026–30. The estimates imply that 0.9218 million jobs will be created each year during the period in question.

5.1 Employment by Skills, Location, and Gender

5.1.1 Investment Simulation

The investment simulation shows that, of the 0.935 million people who will be employed, 72.29 per cent will be men, which is about 0.676 million. The other 0.259 million will be females. Since the results are estimated for the period of 2020 to 2026, on average 0.0965 million males and 0.037 million females will be employed per year (Table 10).

The simulation result can also be disaggregated into three skill categories. Most of the employment would be generated in the low-skill category, which accounts for 59.25 per cent of the total employment. Another 0.332 million jobs will be produced in the medium-skill category. However, as expected, the fewest number of jobs will be created in the high-skill category. The high-skill category comprises only 5.2 per cent of the jobs.

It is expected that most of the jobs created by investments in Matarbari will be in rural areas. A total of 0.677 million jobs will be generated in the rural regions. Another nearly quarter of a million jobs are expected to be created in the urban area. Due to the investment in the Matarbari Development Project, the urban regions will generate 0.256 million jobs during the period of 2020 to 2026. Over the same time period, the rural region will generate nearly three times the number of jobs as the urban region.

Jobs in both urban and rural regions will be dominated by males. The rural regions are set to generate 0.472 million jobs for males and 0.205 million jobs for females. In urban regions, males will be employed in 0.201 million jobs and females will get 0.057 million jobs.

Skill-based, gender-segregated results are consistent with the overall results. In rural regions, a total of 0.429 million

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Table 9: Summary SAM Results

	Investment Simulation		Export Simulation	
	GDP growth (percentage change)	Employment Generation (Annual Average in Million)	GDP growth (percentage change)	Employment Generation (Annual Average in Million)
2020-2026	1.81	0.133	-	-
2026-2030	-	-	6.83	0.9218

Source: Authors' compilation based on SAM Multiplier-based simulation results

Table 10: Investment Simulation Result by Skill and Gender

	Rural			Urban			
Employment Creation (Millions)	**Male**	**Female**	**All**	**Male**	**Female**	**All**	**Total Employment**
Low Skill	0.299	0.130	0.429	0.094	0.031	0.125	0.554
Medium Skill	0.157	0.070	0.227	0.084	0.021	0.105	0.332
High Skill	0.016	0.005	0.021	0.023	0.005	0.028	0.049
Total	0.472	0.205	0.677	0.201	0.057	0.258	0.935

Source: Authors' compilation based on SAM Multiplier-based simulation results

(63.36 per cent), 0.227 million (33.53 per cent), and 0.021 million (3.1 per cent) people will potentially be employed respectively in the low, medium, and high-skill jobs. On the other hand, in the urban regions, the low-skill sector will employ 0.125 million (48.44 per cent) jobs over the time frame, followed by 0.105 million (40.69 per cent) and 0.028 million (10.85 per cent) in the medium and high-skill sectors, respectively.

5.1.2 Export Simulation

For the export simulation, out of the total number of employed people, two-thirds of the jobs will be created for men. A total of 3.055 million males (66.28 per cent) has the potential to be employed across all skill categories. The rest, or 1.554 million jobs, will be for females. Due to increased export, 0.611 million males and 0.31 million females will be employed per year during the estimated period of 2026-30 (Table 11).

There is a potential to employ 2.663 million people (57.77 per cent of total employment) in the low-skill category. On the other hand, it is likely that 1.72 million people will be employed in medium-skill jobs. This is 37.31 per cent of all jobs. Out of 4.609 million potential jobs, high-skilled labor will account for only 0.225 million. The amount is only 4.88 per cent of total employment. The simulation results are consistent with the prior assumption that low-skilled jobs will dominate total employment.

The export simulation is similar to the investment simulation in terms of location-based job creation. The SAM result shows that if 25 per cent of total export growth happens due to the Matarbari DSP, about 3.23 million and 1.37 million jobs will be created, respectively, in the rural and urban regions in the years between 2026 and 2030. As with the results of the investment simulation, the export simulation yields that males will be employed more in both the urban (66.95 per cent) and rural (65.99 per cent) regions (Table 11).

> The export simulation is similar to the investment simulation in terms of location-based job creation. The SAM result shows that if 25 per cent of total export growth happens due to the Matarbari DSP, about 3.23 million and 1.37 million jobs will be created, respectively, in the rural and urban regions in the years between 2026 and 2030.

Table 11: Export Simulation Result by Skill and Gender

	Rural			Urban			
Employment Creation (Millions)	**Male**	**Female**	**All**	**Male**	**Female**	**All**	**Total Employment**
Low Skill	1.318	0.693	2.011	0.396	0.256	0.652	2.663
Medium Skill	0.746	0.387	1.133	0.414	0.174	0.588	1.721
High Skill	0.073	0.021	0.094	0.108	0.023	0.131	0.225
Total	2.137	1.101	3.238	0.918	0.453	1.371	4.609

Source: Authors' compilation based on SAM Multiplier-based simulation results

In the rural area, there will be jobs for low-skilled, medium-skilled, and high-skilled males, respectively at 1.318 million, 0.746 million, and 0.073 million. Employment for females at low-skill, medium-skill, and high-skill jobs will be respectively at 0.693 million, 0.387 million, and 0.094 million. Jobs for both men and women with different kinds of skills in the urban areas will be almost half of that in the rural areas. The rural regions of Bangladesh are primarily agricultural. Moreover, according to the Labor Force Survey 2026–17, the majority of Bangladesh's labor force is employed in low-skilled occupations. In light of these findings, it is plausible that the majority of new jobs will be in the low-skilled category. Similarly, males hold the majority of jobs across all skill categories. The employment generation will therefore be dominated by men, followed by women. The low proportion of high- and medium- skilled occupations in Bangladesh can be attributed to the overall low skill profile that dominates the labor force and employment profiles. The rationale in this instance is that the new jobs created as a result of the Matarbari DSP Project and increased exports through the Matarbari DSP, despite requiring high-skilled employment, will have to primarily absorb low- to medium- skilled labor and will therefore be tailored to the labor market's dynamics.

6. Opportunities and Challenges

The Matarbari DSP will open a new gateway of economic opportunities for Bangladesh. Poised to become a regional commercial hub, the Matarbari DSP has the potential to usher in a new era of regional and international trade for the country and launching it as a centre of connectivity in the Bay of Bengal region. The geo-economic significance of the deep sea port becomes more pronounced when its investment potential is taken into account. With the possibility of foreign investments and industrial activities ever increasing, the deep sea port will act as a growth catalyst for Bangladesh.

It goes without saying that the Matarbari DSP has the potential to become an economic

> “Matarbari DSP has the potential to be transformed into a hub for regional and international trade. With its increased capacity to handle ocean cargo and containers, the Matarbari DSP can place Bangladesh in a position of leverage. This will enable Bangladesh to remove its dependency on the deep sea ports of India, Sri Lanka and Singapore.”

hub for regional and international trade. With its increased capacity to handle ocean cargo and containers, the Matarbari DSP can place Bangladesh in a position of leverage. This will enable Bangladesh to remove its dependency on the deep sea ports of India, Sri Lanka and Singapore.

As a DSP, Matarbari has the potential to reduce Bangladesh's cost of import and export (CPA, 2022). Facilitating export and import at a reduced cost is a core part of Bangladesh's future growth strategy. With Matarbari, Bangladesh will be able to strengthen its export and import capacity. As a result, it will act as a driver of the growth engine.

The investments in the construction of the Matarbari port will have a multiplier effect, as evident from the SAM simulations. The investments will create new jobs and add to the GDP as well. The multiplier effects of the investments in the construction of the Matarbari port will spill across various sectors and contribute to sectoral growth as well.

Investments in Matarbari will also entail investment in road infrastructure. The Matarbari development plan includes a special economic zone as well. The multiplier effects of these investments will be enormous and will be translated into GDP growth.

The Matarbari DSP will act as an incentive for foreign investors as well. With the Matarbari DSP, investors will see Bangladesh as a lucrative investment destination primarily due to two reasons. Firstly, it will be easier for investors to operationalize production facilities, as they will be able to use the port to bring in production machinery at a reduced cost. Secondly, the port will offer the investors greater opportunity in terms of export, as the investors will be able to utilize the port.

Another important aspect of the Matarbari DSP is regional connectivity. Through Matarbari, Bangladesh can boost trade and connectivity with India, Nepal and Bhutan. There is huge scope particularly for India's land-locked northeast region of Assam, Arunachal, Meghalaya, Nagaland, Manipur, Mizoram, Tripura (Matarbari jetties show signs of DSP viability, 2022). There is a scope for bilateral agreements with these countries which will allow these countries to use the Matarbari port. Such agreements will also allow Bangladesh to generate revenues in duty fees.

The DSP offers a unique opportunity for Bangladesh to pursue an agenda of regional integration. Bangladesh can leverage Matarbari as a cornerstone of connectivity across the Bay of Bengal region. In this regard, Bangladesh can emerge as a leader in this region.

However, there are some challenges as well. These challenges are related to various institutional arrangements of the DSP. Also, the aspects of geo-politics and geo-economics need to be taken into consideration as well. Integrating the prospects of Matarbari in Bangladesh's multilateral diplomacy might prove to be challenging as well.

The primary challenges facing the Matarbari DSP is the timely completion

Matarbari DSP is a top priority of the government, and there has been notable progress in this regard. It is expected that the deep sea port will be completed in the stipulated time.

of construction and speedy operationalization of the port. While so far the progress with the port construction has been satisfactory, it must be ensured that pace is sustained. It must be noted that some mega infrastructures have slowed despite initial progress. However, given that the Matarbari DSP is a top priority of the government, and there has been notable progress in this regard. It is expected that the deep sea port will be completed in the stipulated time.

Operationalizing the port, however, will be a major challenge. The Chattogram Port Authority (CPA) is in charge of the development of the Matarbari DSP. As the CPA is already in charge of the Chattogram Port, and there is a need for a proper assessment of CPA's capacity with regard to the Matarbari DSP. More importantly, the plans of operationalization have to be stepped up.

The facilities of the Matarbari DSP need to be maintained and sustained in a way that it caters to the long term demand in terms of container movement. Along with the physical facilities, the port management system has to be modernized as well, with proper implementation of paperless processes. It should be ensured that in Matarbari, customs and other processes are most efficient and conducted in a manner that is on par with other international ports. In this regard, automation and IT-enabled multimodal logistical systems should be introduced.

Without increased efforts to enhance regional connectivity, it would not be possible to realize the full potential of the Matarbari DSP. In this regard, we should invite multilateral initiatives for investments in connectivity and transport infrastructure.

Facilitating export and import at a reduced cost is a core part of Bangladesh's future growth strategy. With Matarbari, Bangladesh will be able to strengthen its export and import capacity. As a result, it will act as a driver of the growth engine.

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Annexure 1: Limitations and Assumptions of the Social Accounting Matrix (SAM)

To build SAM for the analysis, inter-industry data is extended through a more disaggregated income and expenditure structure, which reflects the integration of the link between the institutional sectors with productive activities, goods and services, and intermediate inputs. However, SAM provides an adequate and appropriate database for the analysis of major socio-economic issues such as employment, trade, etc. The model captures the macro transactions of an economic system based on micro-level transfers between all agents in the economy (Pyatt and Round, 1985; Roland-Holst and Reinert, 1997). However, the estimation of SAM requires access to diverse and intricate data and estimates, which are rarely available from a single source. Hence, data from different sources must be compiled systematically. This process of sorting information and data highlights inconsistencies in certain cases between the statistical sources and identifies areas where the reliability of data could be improved. The following are some of the limitations and assumptions under the SAM analysis:

- SAM is a fixed-price model, and the price is assumed to be fixed at 1;
- Prices and expenditure propensities of endogenous accounts are constant;
- The government, rest of the world, and capital accounts are exogenous, while the factors, institutions and sectoral production activities are endogenous;
- Production technology and resource endowments are given for a time period and;

The model assumes that there are no economies or diseconomies of scale in production or factor substitution.

Annexure 2: Basic Structure of Input-Output Table

SAM is an extension of the Input-Output Table (IOT). The extension is made by clubbing other parts (actors) of the economy (i.e. primary and secondary income distribution and institutions of the economy). More specifically, in the Input-output table, each horizontal row narrates how one industry's total output is divided among all other production processes and final consumption, while each vertical column shows the combination of input used within one industry. A table of this type (Table A.2.1) draws the dependence of an industry on the output of other industries.

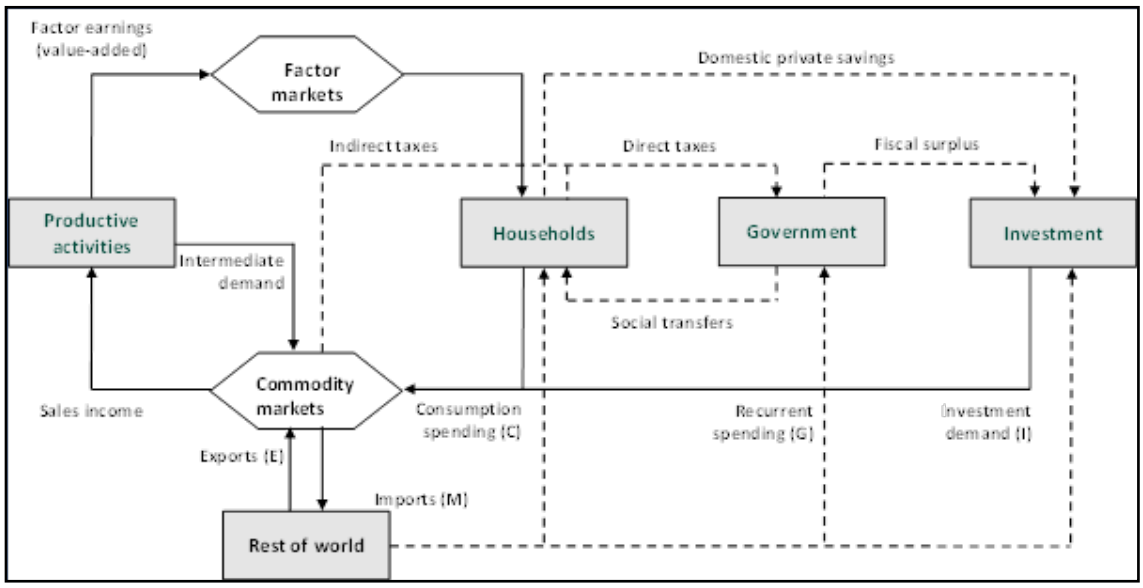
Table A.2.1: Basic Structure of Input-Output Table (IOT)

<table>
<tr><td rowspan="2"></td><td rowspan="2"></td><td colspan="5">Activity</td><td colspan="4">Final Demand</td><td rowspan="2">Total Use</td></tr>
<tr><td>A1</td><td>...</td><td>...</td><td>...</td><td>A100</td><td>C_p</td><td>C_g</td><td>I</td><td>Ex</td></tr>
<tr><td rowspan="4">Commodity</td><td>C1</td><td colspan="5" rowspan="4">Technology matrix (100 x 100)</td><td colspan="4" rowspan="4">Final Demand</td><td></td></tr>
<tr><td>..</td><td rowspan="3"></td></tr>
<tr><td>..</td></tr>
<tr><td>C100</td></tr>
<tr><td rowspan="4">Value-added</td><td>Compensation</td><td colspan="5" rowspan="2">GDP (Income Approach)</td><td colspan="4" rowspan="2">GDP (Expenditure Approach)</td><td></td></tr>
<tr><td>Operating Surplus</td><td rowspan="3"></td></tr>
<tr><td>Indirect Taxes</td><td colspan="5"></td><td colspan="4"></td></tr>
<tr><td>Import</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>Total Supply</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Source: Authors' specification

However, a SAM is an accounting framework that assigns numbers to the income and expenditures in the circular flow diagram (Figure A.2.1). It is a square matrix in which each row and column is called an 'account'. Each of the boxes in the diagram is an account in the SAM. Each cell in the matrix represents, by convention, a flow of funds from a column account to a row account. For instance, the circular flow diagram shows private consumption spending as a flow of funds from households to commodity markets. In the SAM, it is entered in the household column and commodity row. That is, the systematic database of a SAM explicitly incorporates various crucial transactions from the structure of production and the mapping of the household income distribution from the structure of production and the mapping of the household income distribution from the factorial income distribution, among others (Raihan, 2011). The underlying principle of the double-entry accounting requires that, for each account in the SAM, total revenue equals total expenditure.

Figure A.2.1: Circular Flow in an Economy



Source: Breisinger et al., (2009)

Annexure 3: Step-by-Step Procedure for the Construction of APS Matrix

To have a clear understanding, let's consider the general SAM modular structure as shown in Tables A.3.1 and Table A.3.2.

Table A.3.1: General SAM Modular Structure

		1a-PA	1b-CM	2-FP	3a-HH-OI	3b-Gov	4-KHH-OI	5-ROW	TDD
1a	PA		$T_{1a, 1b}$		0				Y_{1a}
1b	CM	$T_{1b, 1a}$			$T_{1b, 3a}$	$T_{1b, 3b}$	$T_{1b, 4}$	$T_{1b,5}$	Y_{1b}
2	FP	$T_{2, 1a}$						$T_{2, 5}$	Y_{2}
3a	HH-OI			$T_{3a, 2}$	$T_{3a, 3a}$	$T_{3a, 3b}$		$T_{2, 5}$	Y_{3}
3b	Gov	$T_{3b, 1a}$	$T_{3b, 1b}$		$T_{3b, 3a}$	$T_{3b, 3b}$		$T_{3a, 5}$	
4	KHH-OI	$T_{4, 1a}$			$T_{4, 3}$			$T_{4, 5}$	Y_{4}
5	ROW		$T_{5, 1b}$	$T_{5, 2}$	$T_{5, 3a}$	$T_{5, 3b}$	$T_{5, 4}$	0	Y_{5}
	TSS	E_{1a}	E_{1b}	E_{2}	E_{3a}	E_{3b}	E_{4}	E_{5}	

Where, Endogenous: 1a PA = Production Activities and 1b CM = Commodities; 2 FP = Factors of Production; 3a HH = Households and Other Institutions (excluding Government);

Where Exogenous: 3b-Gov= Government; 4 KHH-OI = Capital Account of Households and Other Institutions (incl. government); 5 ROW = Rest of the World (current and capital account).

Blank entries indicate that there are no transactions by definition.

Source: Authors' specification

From the SAM, it is easy to come up with the APS matrix (generally known as the coefficient matrix). SAM coefficients (Aij) are derived from payments flows by endogenous accounts to themselves (Tij) and other endogenous accounts as to the corresponding outlay (Ei = Yj); similarly, the leak coefficients (Bij) are derived from flows reflecting payments from endogenous accounts to exogenous accounts (Table A.3.2).

Table A.3.2: Coefficient Matrices and Vectors of the SAM model

Account	1a – PA	1b – CM	2 – FP	3a - HH&OI	3 b … 5 EXO	Income
1a – PA		$A_{1a,1b} = T_{1a,1b} / Y_{1b}$			X_{1a}	Y_{1a}
1b – CM	$A_{1b,1a} = T_{1b,1a} / Y_{1a}$			$A_{1b,3a} = T_{1b,3a} / Y_{3a}$	X_{1b}	Y_{1b}
2 – FP	$A_{2,1a} = T_{2,1a} / Y_{1a}$				X_{2}	Y_{2}
3a - HH&OI			$A_{3a,2} = T_{3a,2} / Y_{2}$	$A_{3a,3a} = T_{3a,3a} / Y_{3a}$	X_{3a}	Y_{3a}
3b … 5 Leaks	$B_{1a} = L_{1a} / Y_{1a}$	$B_{1b} = L_{1b} / Y_{1b}$	$B_{2} = L_{2} / Y_{2}$	$B_{3a} = L_{3a} / Y_{3a}$		
Expenditure	$E_{1a} = Y_{1a}$	$E_{1b} = Y_{1b}$	$E_{2} = Y_{2}$	$E_{3} = Y_{3a}$		

Source: Authors' specification

The multiplier analysis using the SAM framework helps us to understand the linkages between the different sectors and the institutional agents at work within the economy. Accounting multipliers have been calculated according to the standard formula for accounting (impact) multipliers, as follows:

$$Y = AY + X = (I - A)^{-1}X = M_a X$$

where:

Y is a vector of incomes of endogenous variables

X is a vector of expenditures of exogenous variables

A is the matrix of average expenditure propensities for endogenous accounts

$M_a = (I - A)^{-1}$ is a matrix of aggregate accounting multipliers (generalized Leontief inverse).

Variation in any one of the exogenous accounts (i.e., in this case, ΔX) will produce total (economy-wide) impacts (ΔY) of endogenous entries via the multipliers (M_a). Thus-

$$\Delta Y = M_a * \Delta X$$

Here, ΔY captures the economy-wide impacts. The impact can be obtained through the four endogenous accounts namely: (i) gross output; (ii) commodity demand; (iii) factor returns, and (iv) household. Table A.3.3 describes the endogenous and exogenous accounts and multiplier effects.

Table A.3.3: Description of the Endogenous and Exogenous Accounts and Multiplier Effects

Endogenous (y)	Exogenous (x)
The activity (gross output multipliers): indicates the total effect on the sectoral gross output of a unit-income increase in a given account, i in the SAM, and is obtained via the association with the commodity production activity account i.	
The consumption commodity multipliers: indicates the total effect on the sectoral commodity output of a unit-income increase in a given account i in the SAM, which is obtained by adding the associated commodity elements in the matrix along the column for account i.	Intervention into through activities (x = i + g + e), where i= GFC + ST (GFCF) Exports (e) Government Expenditure (g) Investment Demand (i) Inventory Demand (i)
The value-added, or GDP multiplier: gives the total increase in GDP resulting from the same unit-income injection, and is derived by summing up the factor-payment elements along account i's column.	
The household income multiplier: shows the total effect on household and enterprise income and is obtained by adding the elements for the household groups along with the account i column.	Intervention via Households (x = r + gt + ct), where Remittance (r) Government Transfers (gt) Corporation Transfers (ct)

Source: Authors' specification

Annexure 4: Bangladesh 2017 SAM Accounts

Table A.4.1: Bangladesh 2017 SAM accounts

SAM Accounts	Detailed sector classification
Activities (100)	
	Paddy Cultivation, Wheat Cultivation, Other Grain Cultivation, Jute Cultivation, Sugarcane Cultivation, Potato Cultivation, Vegetable Cultivation, Pulses Cultivation, Oilseed Cultivation, Fruit Cultivation, Cotton Cultivation, Tobacco Cultivation, Tea Cultivation, Spice Cultivation, Other Crop Cultivation, Livestock Rearing, Poultry Rearing, Shrimp Farming, Fishing, Forestry
	Mining and Quarrying, Rice Milling, Grain Milling, Fish Process, Oil Industry, Sweetener Industry, Tea Product, Salt Refining, Food Process, Tanning and Finishing, Leather Industry, Baling, Jute Fabrication, Yarn Industry, Cloth Milling, Handloom Cloth, Dyeing and Bleaching, Woven, Knitting, Toiletries, Cigarette Industry, Bidi Industry, Wood and Cork Product, Furniture Industry, Paper Industry, Printing and Publishing, Pharmaceuticals, Fertiliser Industry, Basic Chemical, Petroleum Refinery, Earth ware Industry, Plastic Products, Glass Industry, Clay Industry, Cement, Basic Metal, Metal, Machinery and Equipment, Transport equipment, Miscellaneous Industry, Building, Kutcha House, Agriculture Construction and Other Construction, Electricity, Water Generation, Gas Extraction and Distribution
	Wholesale Trade, Retail Trade, Air Transport, Water Transport, Land Transport, Railway Transport, Other Transport, Housing and Real Estate Service, Health Service, Education Service, Public Administration and Defense, Bank and other Financial Services, Insurance, Professional Service, Entertainment, Hotel and Restaurant, Communication, Other Services, ICT, E-Commerce
Commodities (100)	
	Paddy Cultivation, Wheat Cultivation, Other Grain Cultivation, Jute Cultivation, Sugarcane Cultivation, Potato Cultivation, Vegetable Cultivation, Pulses Cultivation, Oilseed Cultivation, Fruit Cultivation, Cotton Cultivation, Tobacco Cultivation, Tea Cultivation, Spice Cultivation, Other Crop Cultivation, Livestock Rearing, Poultry Rearing, Shrimp Farming, Fishing, Forestry
	Mining and Quarrying, Rice Milling, Grain Milling, Fish Process, Oil Industry, Sweetener Industry, Tea Product, Salt Refining, Food Process, Tanning and Finishing, Leather Industry, Baling, Jute Fabrication, Yarn Industry, Cloth Milling, Handloom Cloth, Dyeing and Bleaching, Woven, Knitting, Toiletries, Cigarette Industry, Bidi Industry, Wood and Cork Product, Furniture Industry, Paper Industry, Printing and Publishing, Pharmaceuticals, Fertiliser Industry, Basic Chemical, Petroleum Refinery, Earth ware Industry, Plastic Products, Glass Industry, Clay Industry, Cement, Basic Metal, Metal, Machinery and equipment, Transport equipment, Miscellaneous Industry, Building, Kutcha House, Agriculture Construction and Other Construction, Electricity, Water Generation, Gas Extraction and Distribution
	Wholesale Trade, Retail Trade, Air Transport, Water Transport, Land Transport, Railway Transport, Other Transport, Housing and Real Estate Service, Health Service, Education Service, Public Administration and Defense, Bank and other Financial Services, Insurance, Professional Service, Entertainment, Hotel and Restaurant, Communication, Other Services, ICT, E-Commerce
Factors of Production (04)	
	Labour factor (03): Low Skilled; Medium Skilled; and (iii) High Skilled
	Capital factor
Institutions (04)	
	Household
	Government
	Corporation
	Rest of the World
	Savings or Gross fixed capital (consolidated capital)

Source: Bangladesh SAM 2017

Endnotes

1. Refer, "Matarbari Deep Sea Port to Be Modelled on Japanese Kashima, Niigata Ports," 2018
2. Refer,"Matarbari Will Become Regional Hub in South-Asian Economy: Experts," 2023.
3. It is expected to cost around Tk 17,777 crore (Aziz, 2020). For the development of a port in Matarbari, the Japan International Cooperation Agency (JICA) will provide Tk 128.93 billion. The Chattogram Port Authority and the government will fund the initiative with a total of Tk 48.84 billion. Refer, "ECNEC Approves Tk 177.77 Billion Matarbari Deep-Sea Port," 2020.
4. In addition to reducing pressure on existing terminals, the Matarbari deep-sea port will play a crucial role in the country's economy, as a thermal power plant and economic zone are being built adjacent to the project (Hossan, 2022).
5. Training is the action of teaching somebody a particular skill. In this study, training refers to a type of skills that are related to employability. Having employability skills can help someone to get a job. A question of "In the last 12 months have you attended any vocational training?" along with individual's average years of schooling will be used from LSF 2016-17 micro dataset.