Report On
"Sustainable Supply Chain Practices in the Development Projects of Bangladesh Rural Electrification Board"

By

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An internship report submitted to the BRAC Institute of Governance and Development (BIGD) in partial fulfillment of the requirements for the degree of Masters in Procurement and Supply Management (MPSM)

BRAC Institute of Governance and Development (BIGD)
BRAC University
December 2023

Declaration

It is hereby declared that-

1. The internship report submitted is my original work while completing the degree of Masters in Procurement and Supply Management (MPSM) at BRAC University.
2. The report does not contain material previously published or written by a third party, except where this is appropriately cited through full and accurate referencing.
3. The report does not contain material which has been accepted, or submitted, for any other degree or diploma at a university or other institution.
4. I/We have acknowledged all main sources of help.

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Letter of Transmittal

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Subject: Letter of Transmittal for the report titled "Sustainable Supply Chain Practices in the Development Projects of Bangladesh Rural Electrification Board"

Dear Sir,

I am pleased to submit the subject mentioned report which was prepared through the analysis of sustainability practices during the contract phases of two development projects of Bangladesh Rural Electrification Board.

In the preparation of this report, I have learned a lot and applied my knowledge and skills to generate the report. I made every effort to gather information for this report to provide in-depth knowledge. I hope that this report meets the requirements and provides insight from an organizational standpoint. Hopefully, you will find my work, efforts, informative approach, and well-researched report useful.

Thank you for considering this report.

Sincerely yours,

_____

Sabrina Hoque
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Date: December 18, 2023

Non-Disclosure Agreement

This agreement is made and entered into by and between the Bangladesh Rural Electrification Board as the First Party and the undersigned student at BRAC Institute of Governance and Development, BRAC University, as the Second Party.

As a partial completion of the requirements for the degree of Masters of Procurement and Supply Management, the First Party has given the Second Party permission to submit a report on the Sustainable Supply Chain Practices in the Development Projects of the Bangladesh Rural Electrification Board.

The Second Party will have the opportunity to work closely with the organization's officials. Based on work experience, data, and information collected, the Second Party will prepare a report. The Second Party will utilize all sorts of data and information for academic purposes and will not disclose it to any party that could be detrimental to the interests of the First Party.

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Acknowledgment

First and foremost, I want to sincerely thank the almighty Allah for enabling me to finish this dissertation report with success. My sincere gratitude goes out to the following individuals and organizations for their assistance and collaboration:

My Academic Supervisor, Inthaqab Wahid Ruso, MCIPS, PMP®, BRAC Institute of Governance and Development (BIGD), BRAC University and Workplace Supervisor, Ashok Kumar Ghosh, Director, (Technical), c.c., Directorate of Programme Planning, Bangladesh Rural Electrification Board: I sincerely appreciate my supervisors' advice, patience, and knowledge throughout the report's development. Your generous time and thoughtful feedback have been invaluable in helping to shape this report.

Officers and Staff of BIGD, BRAC University, especially Dr. Rajmoni Singha, Academic Coordinator, BIGD, and Tanzina Mizan, Training Officer, BIGD, BRAC University: I would want to express my gratitude to them for all of their support during the study period.

Respondents of the Bangladesh Rural Electrification Board, notably Project Directors, Executive Engineers, Deputy Directors (Technical), and other officials related to project developments from various BREB offices: I am appreciative of them for helping me at different stages of the data collecting and for their many official supports

My Parents, Husband, and Friends: I would especially like to thank my family and friends for their continuous encouragement and support.

Librarians and Research Support Staff: I would like to thank them for their help with resource access and technical support.

In conclusion, I would like to express my sincere gratitude to everyone whose assistance has been vital to the success of this academic dissertation report.

Executive Summary

Bangladesh Rural Electrification Board has been established as a vital government institution to help improve the quality of life of the vast rural multitudes and accomplish continuous advancement to their socio-economic conditions through the supply of stable and reliable electric power to the rural areas of the country as well as to fulfill the constitutional right of the people to have electricity. BREB provides electricity services in 61 districts out of 64 and already has achieved 100% electrification connecting 34.77 million consumers with the installation of 1,299 substations of capacity 17,470 MVA and erecting 5 lakh 82 thousand km of distribution lines till June, 2023 by implementing development projects and also by their operational works. Now BREB is focusing on quality, reliability & un-interruption to be with national sustainability goals.

Most of the substations are non-attended outdoor types. Primarily when electrification programs were initiated throughout the country, the power demand was very low. So, pole-mounted substations with small capacity were built. Some of them were totally of wooden structures of poles & cross-arms. With age, these wooden structured substations are in vulnerable condition due to damage to poles and cross arms as these get fired or worn-out causing power interruptions very often. In addition, it has become impossible to meet the increased power demand of the customers from these substations. Besides that, there are some substations in the industrial or economic zones, although those are not wooden structured due to the aged condition of the components of substations these are very less efficient and unreliable in managing the industrial demands of those areas, though at present the country has sufficient Power generation capacity. As these substations are non-attendant, they are also at risk of accidents. Therefore, BREB has planned to rehabilitate these substations with up-gradation and modernization with a multidisciplinary approach, concerned with simultaneously

improving REB' social, economic, and environmental performance through a big sustainable supply chain practices to ensure the best quality of electricity to 34.77 million consumers.

To support the country's economic growth and demand, it will need an uninterrupted, reliable, sustainable, and quality electricity supply. To ensure these BREB already has been implemented, implementing and planning for some projects. BREB will be able to provide this facility to accelerate the activities. These activities will be a manifestation of BREB's effort to cooperate with the Government to achieve the Sustainable Development Goals (SDGs) within 2030 which will ensure "(Goal-07)-affordable, reliable, sustainable and modern energy for all" in elevating Bangladesh into a Developed country within 2041.

For performing the national goals and accounting for the SDG targets, a sustainable supply chain practice (SSCP) entails incorporating socially and environmentally conscious practices into all phases of the product's (electrical goods, construction works, and consulting services) life cycle. A sustainable supply chain is significant because it raises an organization's, company's, or society's level of sustainability. Eco-friendly supply chains, green technology, and other ethical company procedures and economic development are all important components of sustainability. Sustainable services and government practices have a knock-on effect, reducing greenhouse gas emissions and the need for fossil fuels among individuals and communities. A better standard of life is the result of all of this. To do this, a robust, sustainable supply chain was developed by the BREB and is still being practiced in their development works.

To prepare this report, some of the BREB officials like Directors, Executive Engineers, and Project Directors are being contacted who are directly working at the field level. From them, the recent sustainable supply chain practices that have been done in the development projects are being discussed. Data on both ongoing and finished projects are being used in this report.

The BREB officials have shared their previous and present experiences of the development tasks. From their views, to effectively implement sustainable policies, it is essential to have a thorough understanding and accurate perception of sustainability throughout the entire supply chain practices. In essence, sustainability can be regarded as a crucial strategic consideration through a strategic smooth supply chain practice. To successfully address this concern in practical settings, it is essential to have a well-structured strategy, and a proficient workforce, as well as foster the right organizational behavior, culture, and standpoint.

In this report the sustainable supply chain practices (SSCP) followed by the BREB in two development projects (One is completed and another one is ongoing) are discussed briefly in the "Chapter-4 Findings: Sustainable Supply Chain Practices in BREB". BREB is adopting and implementing Sustainable Conceptual Design Practices, Carbon Footprint and Emissions Reduction Practice, Renewable Energy Practices, Environmental, Social, Health & Safety Practices & Sustainable Procurement Practices in their development projects for supplying un-interrupt, reliable & affordable electricity to the consumers. Every step of practicing SSCP in the BREB's developed and developing tasks are in line with the implementation that are and will be ensured.

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List of Acronyms

REB	Rural Electrification Board
BREB	Bangladesh Rural Electrification Board
ACRE	Area Coverage Rural Electrification
GoB	Government of Bangladesh
PBS	Pally Bidyut Samity
SDG	Sustainable Development Goal
SSCP	Sustainable Supply Chain Practices
SCS	Supply Chain Sustainability
CSR	Corporate Social Responsibility
ILO	International Labor Organization
ERP	Enterprise Resource Planning
SCM	Supply Chain Management
CS&M	Carrying, Supply and Management
EIRR	Economic Internal Rate of Return
FRR	Financial Rate of Return
3P model	Triple Bottom Line Model
IoT	Internet of Things
AI	Artificial intelligence
IEEE	Institute of Electrical and Electronics Engineers
IEC	International Electro-technical Commission
ISO	International Organization for Standardization
DNE (DMCS)	Distribution Network Expansion for 100% Rural Electrification (Dhaka, Mymensingh, Chittagong & Sylhet Divisions) 2nd Revised-Project
ANSI	American National Standards Institute
RMPM s/s	Renovation and Modernization of Existing 33/11 kV Wooden Pole Mounted Substations in BREB (Phase-I)- Project
KFW	Kreditanstalt für Wiederaufbau (A German Development Bank)
Euro	The currency and monetary unit of the European Union
GIS	Gas Insulated Substations
MWh	Megawatt-hour
EPC	Engineering, Procurement, and Construction
Turn-Key	Built, supplied, or installed complete and ready to operate
CO2	Carbon dioxide
PSMP	Power System Master Plan
ESHS	Environment, Social, Health, and Safety
EIA	Environmental Impact Assessment
IAIA	International Association for Impact Assessment
NOC	No Objection Certificate
EMP	Environment Management Plan
WBG	World Bank Group
EHS	Environmental Health Standard
ERM	Environmental Resources Management
WB	World Bank

ADB	Asian Development Bank
JICA	Japan International Cooperation Agency
KOICA	Korea International Cooperation Agency
AFD	Agence Française de Développement (French Development Agency)
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit, GmbH German Development Cooperation (GIZ)
IDB	Islamic Development Bank
PPA-2006	Public Procurement Act-2006
PPR-2008	Public Procurement Rules-2008

Chapter 1

Introduction

1.1 Background

The Government of Bangladesh emphasized the top priority to accelerate the pace of the electrification program throughout the country. It is also a constitutional obligation to provide electric power in the rural areas. Bangladesh Rural Electrification Board has been established as a vital institution to help improve the quality of life of the vast rural multitudes and accomplish continuous advancement to their socio-economic conditions through the supply of stable and reliable electric power to the rural areas of the country as well as to fulfill the constitutional right of the people to have electricity. Based on the results of a comprehensive feasibility study in 1976 REB stands on the Area Coverage Rural Electrification (ACRE) concept for serving electricity in a co-operative model. The Government of Bangladesh's vision for the Power Sector is to provide access to affordable and reliable electricity to all. GoB's various plans emphasize the importance of electricity for generating employment opportunities. Access to affordable and reliable electricity is a key requirement for both economic development and poverty reduction. In support of the Government's vision, the Rural Electrification Board has been functioning with a firm aim to enhance electrification programs all over the countryside based on the concept of Area Coverage Rural Electrification (ACRE). The ACRE concept led to the establishment of a cooperative called Pally Bidyut Samity (PBS) to deliver electric services to their member-consumers. Since the inception of the 80 nos. of PBSs have been developed all over the country under different projects from ACRE Phase-I to ACRE Phase-V. After establishing the PBSs, the distribution system of those PBSs was gradually expanded and intensified under the different Intensification and Expansion Projects. After competition of the area coverage, BREB focused on the electricity distribution within its

rural area. For doing this constitutional job, BREB has finally completed 100% electrification by 2021 [1] by implementing significant development construction projects. Now BREB is focusing on quality, reliability & un-interruption to be with national sustainability goals.

The government has shown interest in implementing sustainable supply chain practices during the past few years. Bangladesh is a proactive participant in the UN's Sustainable Development Goals (SDGs) initiative. A sustainable future can be attained by 2030 by addressing social, economic, and environmental issues through the implementation of the 17 Sustainable Development Goals (SDGs). These days, every government agency is attempting to include sustainable issues in their policies. BREB is one of Bangladesh's government engineering departments. As part of their vision and mission, they are all now raising awareness and incorporating sustainable policy. In addition, BREB is trying to incorporate sustainable practices into its contract management, design, and construction phases, among other processes. The forthcoming section of this report is going to focus on the sustainable practices that BREB presently employs.

1.2 Sustainable Supply Chain Practice

Sustainable supply chain practice entails incorporating socially and environmentally conscious practices into all phases of a product's life cycle, from the extraction of raw materials to their eventual disposal. Assuring fair labor practices, reducing the negative effects on the environment, and encouraging ethical sourcing and production techniques are all part of this. The objective is to design a supply chain that, to be sustainable over the long run, strikes a balance between social, economic, and environmental factors.

A supply chain is considered sustainable when it successfully incorporates values and both social and environmental responsibility into a model that is both competitive and successful. Transparency throughout the whole supply chain is essential; sustainability programs need to

cover everything from the sourcing of raw materials to last-mile transportation and even product returns and recycling procedures. [2]

Standards for sustainability and compliance are growing more uniform as establishments place an increasing emphasis on ethical supply chain practices. Ten standards have been established by the UN Global Compact to gauge supply chain sustainability [2]. These include human rights, labor practices, environmental responsibility, and corruption. These tenets stem from the understanding that socially conscious actions and goods benefit not just people and the environment but also enhance brand recognition, competitiveness, and long-term financial success.

1.3 Significance of Sustainable Supply Chain

A sustainable supply chain is significant because it raises an organization's, company's, or society's level of sustainability. To sustainably manage our planet and its natural resources such as air and water, sustainability is essential. Reducing pollution and preserving animal and plant habitats are a pair of advantages of creating a sustainable future and everyday life.

Eco-friendly supply chains, green technology, and other ethical company procedures and economic development are all important components of sustainability. Sustainable business and government practices have a knock-on effect, reducing greenhouse gas emissions and the need for fossil fuels among individuals and communities. A better standard of life is the result of all of this. [3]

1.3.1 Potentiality of Sustainable Supply Chain Practices

Reduced environmental impact: Initiatives related to SCS are crucial for enhancing the environment. They contribute to environmental protection and the reduction of pollution. SCS programs help with the appropriate disposal of waste materials, minimize waste, and use fewer natural resources. They also support the use of renewable energy sources and waste material

recycling. These programs also lessen surface runoff, cut greenhouse gas emissions, and enhance air quality.

Improved continuity of supply: Organizations can enhance their relationships with stakeholders and customers by implementing sustainable supply chains. Stakeholders can link specific elements of the supply chain with their purchases, and they are growing more conscious of how their purchases affect the environment. Sustainable supply chain management instills confidence in the consumer market in this way. They are aware that the businesses from which they buy goods actively contribute to the protection of the environment and the well-being of their employees.

Maximizes Output: Organizations that have implemented sustainable supply chain management have seen an uptick in employee morale as a result of employees being aware of how their work contributes to social well-being. Knowing that they are having an impact on their company will also make employees feel more committed to their work and excited about their jobs. Therefore, when workers feel like they are contributing to a common goal, they are generally more productive, which eventually results in increased output.

Minimizes Costs: Organizations can also save money by lowering production costs through sustainable supply chain management, which lowers consumer prices. A company's production costs can be decreased if it can find alternatives to the materials being used. The consumer can then receive the goods at a lower cost to give back while simultaneously increasing sales and profits.

Improves Income: Finally, profitable supply chain management can also be aided. This is the outcome of the productivity gains and drop in production costs that are frequently seen with SCS management. Reducing the amount of energy and resources used during production makes it simpler, more effective, and less expensive. Additionally, by researching the effects of their

decisions on others in the supply chain, corporations can make more profitable decisions over the long term.

1.3.2 Three Sustainable Fundamentals for Managing Supply Chain

These can establish a path towards a sustainable future as well as perform a smooth management or practicing supply chain by focusing on the environmental, economic, and social fundamentals of sustainability. [3]

Environmentally Sustainable Supply Chain Practice	:	Environmentally sustainable supply chain practices focus on minimizing the ecological impact of a product's life cycle. This involves reducing resource consumption, minimizing waste generation, and adopting environmentally friendly processes. Key elements include using renewable resources, optimizing transportation to reduce emissions, and implementing energy-efficient production methods. The aim is to create a supply chain that operates in harmony with the environment, mitigating environmental degradation and promoting the overall well-being of ecosystems.
Economical Sustainable Supply Chain Practice	:	Supply chain resilience and financial viability are the main goals of economically sustainable supply chain practices. Cost optimization, increased productivity, and promoting financial stability for all parties are all part of this. To guarantee a steady and dependable supply of materials, strategies could include effective inventory management, economical transportation, and cultivating long-term relationships with suppliers. The goal is to develop a supply chain

		that not only meets economic objectives but also maintains long-term profitability while taking into account the needs of both the business and its partners.
Social Sustainable Supply Chain Practice	**:**	Socially sustainable supply chain practices emphasize fair labor practices, human rights promotion, and ensuring the well-being of workers throughout the supply chain. This involves considering things like offering secure working environments, paying workers fairly, and upholding their rights. Social sustainability also entails addressing social issues in the supply chain, fostering diversity and inclusion, and interacting with local communities. The goal is to establish a supply chain that upholds human rights, fosters positive relationships with communities and workers, and positively impacts social well-being.

1.4 Reasons for Sustainable Supply Chain

The following are some main arguments in favor of a sustainable supply chain:

Environmental safeguarding: Sustainability reduces the adverse effects of human activity on the environment, protects ecosystems and biodiversity, and encourages the wise use of natural resources. Future generations can live in a sustainable and habitable world if we protect the planet's health. And future demands can be safeguarded by a sustainable supply chain that performs well on environmental issues. [2] [3]

Control of Global Climate Change: One of the biggest global concerns is climate change, which requires sustainable solutions. Reduced greenhouse gas emissions and the promotion of

sustainable practices can help lessen the effects of climate change, including extreme weather events, rising sea levels, and ecosystem disruption. [2] [3]

Resource Conservation and Efficiency: Sustainable supply chain practices place a strong emphasis on managing and using resources like energy, water, and raw materials as optimally as possible. Reducing waste, minimizing resource depletion, and ensuring resource availability for future generations can all be achieved through the adoption of sustainable approaches. [2] [3]

Sustainability and Resilience: Long-term economic stability depends on sustainability. Through the integration of sustainable practices into supply chains, investments, and business operations, it is feasible to mitigate risks, optimize efficiency, and bolster economic resilience. In addition to spurring innovation, sustainability can open fresh avenues for job creation and economic expansion. [2] [3]

Credibility and Commercial Impact: Industries' credibility and perceived worth can be improved by adopting a sustainable business model. Businesses that are socially and environmentally conscious are in greater demand from investors, employees, and customers. Strong CSR makes an organization more appealing to all of its stakeholders. [2] [3]

Sustainability with a proper supply chain is essential because it protects the environment, ensures the health of the planet, advances social justice, stabilizes the economy, and addresses global issues. It is feasible to build a resilient, prosperous, and inclusive world for both the current and upcoming generations by implementing sustainable practices.

Chapter 2

Literature Review

The concept of sustainability is not new to the professional community. Every organization, regardless of their sector of operation, needs to be aware of it. The reasons are clear: An organization's actions will affect the environment regardless of what it does. This has a lot of good effects, like boosting the economy, fostering creativity, and introducing new goods and services that advance societal progress. By purchasing goods, works, and services, organizations like Bangladesh Rural Electrification Board (BREB) as an electricity distribution public organization of Bangladesh contribute positively to economic and social development in national and global supply chains. Development policy thus benefits from a component of national and global supply chains.

2.1 “5 Cs” of Sustainable Supply Chain Practice

The goal of this report is to acquaint by emphasizing the "5 Cs," or the five hierarchical qualities- Consciousness, Conservation, Community, Commerce, and Culture. I will now go into greater detail about each of these and then talk about how writing for various academic audiences can create tensions between them. [4]

2.1.1 Consciousness

Consciousness in sustainable supply chain practices refers to an awareness of, and deliberate consideration of, ethical, social, and environmental factors throughout the supply chain. This entails making deliberate decisions to reduce adverse effects, encourage ethical sourcing, and improve sustainability overall. It demonstrates a commitment to long-term environmental and social well-being in supply chain operations and includes ethical treatment of workers, responsible resource management, and reducing carbon footprint.

Organizational guidelines that demonstrate a strong commitment to sustainable behavior practices, particularly as they relate to the supply chain, should serve as the foundation for the implementation of sustainable supply chain management. These recommendations ought to make explicit reference to international laws, such as the ILO's Core Labor Standards, pertinent UN resolutions, and other international agreements, like the Guiding Principles on Business and Human Rights. In this report, the brief description of exercising these international standards by BREB is elaborately discussed for sustainable goals in a supply chain manner. In the recent and upcoming projects, BREB is maintaining such sustainable standards and targets with a smooth supply chain. [4]

2.1.1.1 Role of Consciousness in Sustainable Supply Chain Practice

- Ensuring that raw materials and products are sourced from suppliers who adhere to fair labor practices and ethical standards.
- Evaluating and mitigating the environmental impact of supply chain activities, including resource consumption, waste generation, and emissions.
- Providing visibility into the supply chain, allowing stakeholders to trace the origin of products and ensuring accountability for sustainable practices.
- Fostering collaboration among supply chain partners, encouraging shared responsibility for sustainability goals and initiatives.
- Embracing innovative technologies and practices that reduce environmental impact, enhance efficiency, and contribute to social responsibility.
- Adhering to recognized sustainability standards and certifications to meet industry and regulatory expectations.
- Regularly assessing and improving sustainability performance, responding to changing environmental and social challenges.

In essence, consciousness in sustainable supply chain practices involves a holistic approach, considering not only economic factors but also social and environmental dimensions to create a more responsible and resilient supply chain.

2.1.2 Conservation

Conservation in sustainable supply chain practices involves the responsible and efficient use of resources throughout the supply chain to minimize environmental impact. This includes efforts to reduce waste, conserve energy, and promote biodiversity.

The risk conservation that is typically significant for a supply chain analysis and how to rank them in order of importance to implement sequentially or not. Conservation is a mandatory sustainable supply chain credential. Therefore, the challenge is to assess conservation using a range of criteria to determine whether and when to check that specific suppliers are adhering to employment, social, and environmental standards. Naturally, the ratios for the various scenarios can change based on personal evaluations and choices about priorities. The degree of conservation to third parties needs special consideration. A higher priority should be given to this risk when it is significant. The BREB development project is putting sustainable priorities into practice by avoiding non-renewable energy consumption, accepting sustainable conceptual design and materials, and so forth. This report includes descriptions of some of these discussions. [4]

2.1.2.1 Role of Conservation in Sustainable Supply Chain Practice

- Optimization of the use of raw materials, water, and energy to reduce overall consumption and waste generation.
- Implementation of the strategies to minimize and responsibly manage waste at every stage of the supply chain, from production to distribution and disposal.

- Adopting energy-efficient technologies and practices to decrease energy consumption and lower the carbon footprint of supply chain operations.
- Considering the impact of supply chain activities on ecosystems and biodiversity, and taking measures to preserve and protect natural habitats.
- Embracing circular economy principles, such as recycling, reusing, and refurbishing products and materials to extend their lifecycle and reduce environmental impact.
- Choosing environmentally friendly packaging materials and designs to minimize waste and pollution.
- Conducting assessments to understand and minimize the environmental impact of products and processes throughout their entire life cycle.

Conservation in sustainable supply chain practices aims to balance the needs of the present without compromising the ability of future generations to meet their own needs, fostering a more environmentally responsible and resilient supply chain.

2.1.3 Community

In sustainable supply chain practices, "Community" refers to a focus on social responsibility and positive engagement with the communities affected by or involved in the supply chain. This involves considerations for the well-being and development of local communities, workers, and other stakeholders.

Like big organizations, a large number of smaller and medium-sized businesses already incorporate social responsibility into their operations. They are compelled to fulfill their social responsibilities about their supply chains, as they are the source of a significant portion of environmental impacts, while also feeling pressure to do so. Additionally, supply chains offer a great deal of potential and chance to prevent or at least lessen significant risks to the environment, those affected, and the businesses themselves. The disastrous results of suppliers'

lax security and occupational health and safety regulations highlight how critical it is for businesses to address the social impact of their supply chain operations as well.

The largest public electricity distribution authority has been carrying out this duty since 1978 and is known as the Bangladesh Rural Electrification Board. The traditional consumer response to having electricity is a constitutional right which was a small percentage in the prior year. By raising social consciousness and carrying out environmental protection measures, BREB has effectively completed the task of raising the percentage from a lower amount to 100%, and development initiatives were put into action. To do this, a robust, sustainable supply chain was developed and is still being practiced. [4]

2.1.3.2 Role of Community in Sustainable Supply Chain Practice

- Ensuring that workers in the supply chain are treated ethically, with fair wages, reasonable working hours, and safe working conditions.
- Investing in and supporting the development of local communities where supply chain activities occur, contributing to economic, social, and environmental improvements.
- Prioritizing local suppliers and producers to support local economies and reduce the environmental impact associated with transportation.
- Involving and communicating with local communities, workers, and other stakeholders to understand their needs and concerns, fostering collaboration and trust.
- Conducting assessments to understand and address the social impact of supply chain activities on communities, including potential risks and opportunities.
- Promoting diversity and inclusion within the supply chain, ensuring equitable opportunities for all individuals regardless of background or identity.
- Upholding and respecting human rights throughout the supply chain, addressing issues such as child labor, forced labor, and discrimination.

By incorporating community-focused practices, sustainable supply chains aim to contribute positively to the social fabric of the areas in which they operate, fostering long-term relationships and mutual benefits.

2.1.4 Commerce

"Commerce" in sustainable supply chain practices refers to conducting business ethically and responsibly, making sure that social and environmental responsibilities are balanced with economic considerations.

Planning, sourcing, production, distribution, and returns are the five most important stages of supply chain management in the establishment of commerce. The duties of a supply chain manager include cost control, shortage prevention, and reduction of supplies. The complete supply chain operates in the organization's direction when these five steps are coordinated. [4]

2.1.4.1 Planning of Commerce for Sustainable Supply Chain Practice

Planning to match supply with customer and manufacturing demands is usually the first step in the process of getting the best results from supply chain management. Businesses need to make an effort to forecast their needs and take appropriate action. This will consider staffing requirements, equipment capacity and limitations, and the raw materials or components required at each stage of manufacturing. Enterprise Resource Planning (ERP) software is frequently used by big organizations to help coordinate the process. BREB is using the ERP software for their resource planning to implement perfectly the development projects and also for doing their regular operational maintenance works.

2.1.4.2 Sourcing in Commerce for Sustainable Supply Chain Practice

Good supplier relationships are essential to the success of SCM processes. Working with suppliers to provide the materials required for the manufacturing process is known as sourcing.

While the requirements for sourcing will vary depending on the industry, SCM sourcing generally entails making sure that 1) the components or raw materials meet the manufacturing specifications required for the production of the goods, 2) the supplier/contractor/service provider received payment at a price that is consistent with market rates, 3) In the event of unanticipated circumstances, the supplier/contractor/service provider can provide emergency materials & 4) the supplier/contractor/service provider has a track record of providing high-quality, on-time deliveries.

Managing the supply chain is particularly important for manufacturers who produce perishable goods. When procuring supplies, companies ought to consider lead times and the degree to which a supplier can fulfill their requirements. This report briefly discusses how a BREB project that has been completed has carried out numerous enormous development projects by adhering to a good sourcing methodology of the goods, works, and consultancy services. The BREB employs similar sustainable supply chain techniques for their other projects.

2.1.4.3 Manufacturing in Commerce for Sustainable Supply Chain Practice

At this point in the supply chain management process, the company turns the components or raw materials it has received from its suppliers into something new by using its labor force and machinery. Although it is not the last phase of supply chain management, this finished product is the ultimate objective of the production method.

Sub-steps in the manufacturing process, like assembly, testing, inspection, and packaging, can be separated further. Businesses need to be aware of waste and other factors that could lead to straying from their original plans during the manufacturing process. For instance, a company needs to address the problem or go back and review the earlier stages of supply chain management if it is using more raw materials than anticipated and procured because of insufficient employee training.

International standards were followed in the assembly, testing, inspection, and packaging of every material that the BREB procured for their development infrastructures. Every stage of the procurement of electrical materials, works, and services has standardized specifications that have been approved for use by suppliers, contractors, and consultants both domestically and abroad.

2.1.4.4 Delivery Process in Commerce for Sustainable Supply Chain

After goods are manufactured and sales are completed, a business needs to get the goods into the hands of its clients. An organization that has efficient supply chain management (SCM) will have strong delivery networks and logistical capacities to guarantee the prompt, affordable, and safe delivery of its goods.

This entails having a fallback or a variety of distribution strategies in case one mode of transportation becomes momentarily unusable. Carrying, Supply, and Management (CS&M), a distinct department of BREB, is responsible for managing delivered goods, defining the delivery point, determining the unit rate of delivery based on the ton per km transportation rate for each electrical material, and managing stores and warehouses using advanced software and techniques.

2.1.4.5 Return in Commerce for Sustainable Supply Chain Practice

The support for product and customer returns marks the end of the supply chain management process. When a customer needs to return a product, it can be particularly problematic if the company makes a mistake. Reverse logistics is the term used to describe this return process, and the business needs to make sure it can accept returned goods and accurately issue refunds for them. The customer transaction needs to be rectified, regardless of whether the company is carrying out a product recall or a customer is merely dissatisfied with the product.

Returns can also be a useful source of feedback for the business, allowing it to find and fix issues with poorly made or defective products. However, the supply chain management procedure will have failed and future returns are likely to continue if the root cause of a customer return is not addressed.

The completed project of BREB is showing already the return on the investment significantly higher than anticipated. The Economic Internal Rate of Return (EIRR) and the Financial Rate of Return (FIRR) are starting their real output with higher value. So, good sustainable development is ensured by maintaining a good sustainable supply chain practice. The ongoing project is implementing its development works with the same feature of sustainable supply chain practices.

2.1.5 Culture

"Culture" in sustainable supply chain management refers to the norms, values, and behaviors of the organization that place a high priority on social, ethical, and environmental responsibility. It entails cultivating an organizational culture that values sustainability through the supply chain.

A supply chain commences with the procurement of components or raw materials from a supplier and concludes with the delivery of a final good or service to the customer. Every link in the supply chain has the potential to improve efficiency or add value to supply chain management. A well-managed supply chain management program can boost a business's earnings while cutting expenses. So, making an optimum decision for a way forward in any step is the main concision. The project director/manager should have such quality with the highest responsiveness and responsibility. [4]

2.1.5.1 Role of Culture in Sustainable Supply Chain Practice

- Demonstrating a commitment to ethical behavior at all levels of the organization, with leaders setting an example for responsible decision-making.
- Involving employees in sustainability initiatives, fostering a sense of responsibility, and encouraging innovative ideas for minimizing environmental impact.
- Providing ongoing training to employees on sustainable practices, ensuring they understand the importance of social and environmental responsibility in their roles.
- Building a culture of collaboration with suppliers, customers, and other stakeholders to collectively work toward sustainability goals.
- Encouraging a culture of innovation that seeks new ways to reduce environmental impact, improve efficiency, and contribute to social well-being.
- Integrating Corporate Social Responsibility (CSR) principles into the company's mission and values, aligning business objectives with societal and environmental goals.
- Cultivating a mindset of continuous improvement, where the organization regularly assesses and enhances its sustainability performance.
- Organizations can establish a framework that encourages a proactive approach to social and environmental responsibility in all facets of their supply chain operations by integrating a sustainable culture throughout the organization

2.2 Sustainable Supply Chain Models

The nature of supply chain management varies amongst businesses. Every company has unique needs, limitations, and advantages that influence how it handles supply chain management. A business/ organization can use some of these models to direct its supply chain management initiatives. [5]

2.2.1 Circular Supply Chain Model

This model emphasizes the circular economy principles, focusing on reducing, reusing, recycling, and refurbishing products and materials to minimize waste and environmental impact.

Example: A clothing company that designs products for recyclability, encourages customers to return old garments for recycling, and uses recycled materials in new clothing items.

2.2.2 Lean and Green Supply Chain Model

Combining lean manufacturing principles with environmental sustainability, this model aims to optimize efficiency while minimizing resource use, waste, and emissions.

Example: An electronics manufacturer implementing lean practices to reduce excess inventory and waste while incorporating energy-efficient processes and materials in production.

2.2.3 Triple Bottom Line Model

Also known as the "3P" model, it considers three dimensions: People, Planet, and Profit. This approach seeks to balance economic success with social responsibility and environmental stewardship.

Example: A food company that considers not only profit but also social impact by supporting local farmers, ensuring fair wages for workers, and minimizing environmental impact through sustainable farming practices.

2.2.4 Closed-Loop Supply Chain Model:

This model emphasizes closed-loop systems where products are designed to be easily disassembled and recycled, creating a sustainable loop of materials within the supply chain.

Example: An automotive manufacturer designing cars with easily recyclable materials, facilitating the return of end-of-life vehicles for disassembly and recycling.

2.2.5 Resilient Supply Chain Model

Focused on building resilience against environmental and social risks, this model aims to ensure continuity in the face of disruptions, such as climate events or geopolitical changes.

Example: An apparel retailer diversifies its supplier base to mitigate risks associated with geopolitical events, natural disasters, or other disruptions.

2.2.6 Local Sourcing and Production Model

Prioritizing local suppliers and production facilities to reduce transportation-related emissions and support local economies.

Example: A food and beverage company prioritizing local farmers and suppliers to reduce transportation-related emissions and support local economies.

2.2.7 Supplier Collaboration Model

Involving close collaboration with suppliers to jointly work towards sustainability goals, ensuring that the entire supply chain is aligned with responsible practices.

Example: A technology company working closely with its suppliers to ensure responsible sourcing of minerals, ethical labor practices, and adherence to environmental standards.

2.2.8 Ethical Sourcing Model

Emphasizing the importance of sourcing materials and products from suppliers who adhere to ethical labor practices and environmental standards.

Example: A coffee company sourcing beans from certified fair trade and organic farms, promoting ethical treatment of workers and environmentally friendly farming practices.

2.2.9 Demand-Driven Supply Chain Model

Focusing on responding to actual demand to reduce excess inventory and waste, optimizing production and distribution based on real-time demand signals.

Example: An e-commerce company utilizing real-time data and analytics to adjust inventory levels and production based on actual customer demand, reducing excess inventory and waste.

2.2.10 Digital Supply Chain Model

Leveraging digital technologies such as IoT, AI, and blockchain to enhance transparency, traceability, and efficiency, contributes to sustainability goals.

Example: A consumer electronic company using blockchain to enhance traceability, allowing customers to verify the origin and authenticity of raw materials used in their products.

These models are not mutually exclusive, and organizations often tailor their approach based on their specific industry, goals, and values. Adopting a sustainable supply chain model involves a comprehensive strategy that integrates environmental, social, and economic considerations throughout the entire supply chain.

Chapter 3

Methodology

This report's goal is to acquire knowledge about the most recent sustainable supply chain practices used in Bangladesh Rural Electrification Board (BREB) development projects.

At first, a list of the completed and ongoing development projects will be collected. As this report will mainly focus on two development projects (One completed and one ongoing), the following documents are planned to be collected [6] [7]:

For Completed Project

- Project Completion Report
- Approved Latest Revised Development Project Proposal (DPP)
- Implementation, Monitoring, Evaluation Department (IMED) Reports, Planning Commission
- Environmental Impact Assessment (EIA) Report

For Ongoing Project

- Feasibility Study (FS) Report
- Environmental, Social, Health and Safety (ESHS) Report
- Environmental Impact Assessment (EIA) Report

Also, the field and project development engineers, specifically the Project Directors, Executive Engineers, Deputy Directors (Technical), and related officials who are Grade-5 and Grade-6 officers of the People's Republic of Bangladesh were interviewed in individual and over cellphone conversations to gather the data used in this report. To acquire data and information, about five engineers including the report supervisor are interviewed. The appendix contains the list of questions that were asked during the data collection phase.

Chapter 4

Findings: Sustainable Supply Chain Practices in BREB

To fulfill the Sustainable Development Goals (SDGs) by 2030 and guarantee "(Goal-07)-affordable, reliable, sustainable and modern energy for all," BREB is working with the government to implement development activities through projects, which will help Bangladesh become a developed nation by 2041. BREB is constructing the government electrical distribution infrastructures in rural areas on behalf of a government organization. Here the sustainable supply chain practices followed by the BREB in two development projects (Completed and Ongoing) as mentioned below will be discussed.

4.1 Project Descriptions

4.1.1 Completed Project

Very recently BREB has completed a project named “Distribution Network Expansion for 100% Rural Electrification (Dhaka, Mymensingh, Chittagong & Sylhet Divisions) 2nd Revised”. This project is also known as “DNE-DMCS” [8]. This project provided 100% Electrification in the project areas. To achieve this national goal BREB has done properly the following constructions.

- Construction of New Distribution Line: 47,840 Km.
- Construction of 33/11 kV New Sub-station: 68 Nos. (940 MVA).
- Augmentation of Existing 33/11 kV Sub-station: 100 Nos. (1000 MVA).
- Construction of River crossing tower: 37 Sets.
- Construction of Switching station: 1 Nos.
- Acquisition/Purchase of Land: 19.20 Acre
- Consumer connection: 17,10,000 Nos.

This development project took 7 years (01-January-2017 to 31-12-2022) for the completion of the above development tasks and expenditure of 6646.00 Crore BDT from GoB money. [8] [9]

4.1.2 Ongoing Project

One of the ongoing projects in the BREB is “Renovation and Modernization of Existing 33/11 kV Wooden Pole Mounted Substations in BREB (Phase-I)” has started its implementation from 1st July 2022 with an estimated cost of 697.72 Crore BDT whereas a foreign development partner (KFW-GERMAN) issued a loan of 50 million EURO and rest of the funds are from GoB. This project is known as “RM-Pole Mounted S\S”. This project has 4 years duration and already 1 and a half years have passed. BREB has so many poor pole-structured substations that are in a very vulnerable condition. Among them, 23 nos. of vulnerable substations are going to be modernized & renovated with the most advanced design of Gas Insulated Substations (GIS) through this project. And of these substations’ adjacent lines, the 2760 km 11 KV feeder line will be renovated with re-conducting with a higher size conductor. [10] [11]

4.2 Sustainable Supply Chain Measures

4.2.1 Sustainable Conceptual Design Practices

Sustainable design parameters, drawings, layout & material specifications for renovation, rehabilitation, and upgradation of new/existing electric distribution lines, substations, switching stations, river crossing towers, sub-marine cables laying & underground cable network installation will be elaborated based on electrical system parameters and environmental circumstances considering weather and climate resilient infrastructure considering international standards as IEEE, IEC, ISO, electrical structural codes & building codes, etc. Sustainable conceptual design practices are the way out of the traditional conventional designs that were practiced before.

4.2.1.1 Sustainable Conceptual Design as Sustainable Supply Chain Practice

For several reasons, well-designed and efficiently run electrical distribution lines, substations, and other electrical structures are conclusively a sustainable choice. Sustainable design minimizes adverse effects on the environment and building occupants while optimizing structural performance. Cost, environmental, social, and human benefits are balanced by incorporating sustainable design and energy efficiency principles into our construction and modernization projects to meet the mission objectives and functional requirements of the development agencies.

The objectives of sustainable design principles are:

Optimize site potential: Proper site selection is an important step towards establishing sustainable structures. Numerous environmental factors are impacted by a structure's location, including security, accessibility, and energy consumption within the covered area and by occupants' electricity needs for potential usages, effects on the local ecosystem, and the use or reuse of existing structures or infrastructure. Therefore, to make sure that factors like solar access and accessibility to public electricity demand are appropriately considered, it is crucial to address site selection very early in the project development process.

Minimize non-renewable energy consumption and waste: Non-renewable consumption is reduced when international standards like IEEE, IEC, ISO, electrical structural codes, and building codes are taken into consideration when designing electrical distribution structures. The consumption of non-renewable resources, such as iron, sand, copper, aluminum, brass, and so forth, results in increased losses and a reduction of natural resources. In general, non-renewable energy consumption is replaced by new energy-related interventions as well as the use of materials through sustainable design.

Use environmentally preferable products: Utilizing recycled materials in electrical systems lessens the need for new resources and helps keep waste out of landfills. Electrical components can be successfully integrated with recycled copper, aluminum, and plastic without sacrificing functionality or safety. For electrical systems, using biodegradable substitutes for conventional insulating materials provides a sustainable solution. Eco-friendly materials with superior thermal and electrical qualities include cellulose-based insulation and bio-based polymeric materials. Companies can harness clean and sustainable power by integrating renewable energy sources, like solar panels and wind turbines, into industrial electrical systems. These resources can offer a dependable and environmentally beneficial energy source while lowering reliance on fossil fuels. Choosing environmentally friendly wiring options, like those derived from soy or vegetable oil, removes the need for goods derived from petroleum. These substitutes offer better performance and fire resistance in addition to lessening their negative effects on the environment.

Protect and conserve energy & Improve energy quality: The idea that all the electric energy in a closed system stays constant over time is known as the conservation of electric energy principle. Essentially, this indicates that although electric energy can change forms, its overall quantity never changes. The goal of energy conservation is to use less energy overall while still getting the same results. This practice may lead to increases in human comfort, financial capital, environmental value, and national and personal security. So, the electrical distribution lines, substations, and other electrical structures should be designed with such standards that can protect and conserve energy moreover it can improve energy quality as well.

Enhance operational and maintenance practices: The seamless operation of electricity facilities depends on having electrical systems that are dependable and efficient. The following are some major justifications for why sophisticated electrical maintenance is crucial:

Ensuring Stakeholder Safety: Staff members and consumers may be in danger due to electrical malfunctions. Frequent maintenance lowers the likelihood of accidents or system failures by assisting in the identification and removal of possible hazards.

Reducing Outages: Distribution outages can have detrimental effects on consumers' care, income, and reputation. By proactively identifying problems, strategic electrical maintenance reduces the likelihood of system failures and unscheduled downtime.

Optimizing Energy Efficiency: Sophisticated electrical maintenance techniques assist in finding ways to cut waste, save energy, and eventually save operating expenses. Stakeholders are required to abide by safety codes and regulations about electrical safety.

In Bangladesh, the Power Cell, an individual department of the Power Division assures the specification of the electric material, constructions, and consultants for all the implementing agencies like REB, PDB, DPDC, DESCO, WZPDCL, NZPDCL, Coal-Power, PGCB, SREDA etc. And it is called uniform specification which is being maintained by World Bank guidelines through several international consultants. So, all the highest level of specifications from the world standards like IEEE, ANSI, etc. are maintained.

4.2.1.2 Findings of Sustainable Conceptual Design Practices for the Two Selected Projects

BREB has given importance to implementing sustainable conceptual design practices in the two selected projects and the findings can be summarized below:

DNE-DMCS

- The design followed international standards like ANSI, IEEE, IEC, ISO, electrical structural codes, and building codes.

- Ensured the highest level of sustainability in the materials specifications, design parameters, and construction supervision.
- Ensured construction of sustainable site design sufficiently responsive to the eco-region, and ecological places.
- Ensured the maximum usage of land with the highest energy potential.
- Usage of non-renewable energy consumption-reducing material.
- Usage of eco-friendly (biodegradable, recyclable) materials.
- Only near to 5% usage of wooden poles.
- Usage of indoor-type substations not disturbing the adjacent living elements of the earth. [9] [12]

RM-Pole Mounted S\S

- Design and specifications followed design and specifications as per Bangladesh's national, local, legal, and institutional framework; KFW Sustainability Guidelines and Guidelines.
- Upgradation of 23 nos. of substations targeting a transformer energy loss reduction of 18,400 MWh per year.
- Appointing international design and supervision consultant experienced with sustainable executions and delivery to projects.
- Appointing EPC/ Turn-Key contractors through international bidding, who will have a greater experience with sustainable design. [10] [13]

4.2.2 Carbon Footprint and Emissions Reduction Practice

The use of green building rating systems, sustainable energy sources, sustainable materials, developing insulation, and effective building management systems are some strategies and techniques for reducing carbon footprint and emissions.

4.2.2.1 Carbon Footprint and Emissions Reduction Practice as Sustainable Supply Chain Practice

In developing nations, the costs of sustainable development are rising due to climate change. Consequently, this will have an impact on the developed countries' economies and the global supply chain. Developing low-carbon, climate-resilient growth is a commitment to the planet's future. To keep global warming to 1.5°C, emissions must peak as soon as feasible and then rapidly decline. To reach net zero emissions by 2050, global carbon emissions must plummet by an astounding 45% from 2010 levels by 2030 and continue to decline sharply after that. Since carbon dioxide is currently responsible for much of the warming brought on by human activity, it is commonly reported that carbon dioxide is the most significant anthropogenic greenhouse gas.

Greenhouse effects are-

Global Warming: Although the greenhouse effect keeps the temperature constant, more of it means higher temperatures. The planet's average temperature and climate are rising because of increased fossil fuel use, increased greenhouse gas emissions, etc. Summer temperatures over the last several years have been significantly warmer than the decadal average trend. The capacity of the gases to retain heat and return it to the earth grows along with them. The earth's temperature rises as a result every time.

Rising Water Levels: The rise in water levels over the safe limits comes next. It's a straightforward logic. The polar ice caps are melting quickly due to the earth's average temperature rising steadily. Water levels are rising dramatically as a result, much higher than is safe. The swift rise in ocean levels can inevitably cause low-lying areas to flood and necessitate evacuation. In addition to causing human deaths and displacement, rising water

levels will also destroy plants and animals. In addition, there is a serious threat to the survival of polar bears and penguins on their polar caps.

Destroying Marine Life: Oceans are known to retain their alkalinity and absorb CO2. However, marine life is negatively impacted by the rate at which carbon dioxide is rising. As the oceans absorb an increasing amount of carbon dioxide, their alkalinity levels will approach hazardous levels. This is becoming a more significant threat to marine life, which could become extinct if the rise in alkalinity keeps up.

4.2.2.2 Findings of Carbon Footprint and Emissions Reduction Practices for the Two Selected Projects

By implementing the development projects, BREB is comparably practicing carbon emissions.

DNE-DMCS

- Reduction of use of diesel as an energy source for pumping, agriculture processing, light industry, and commerce and service delivery.
- *Estimation of the reduction in CO2 emission resulting from lower losses in the power system as follows:*

A CO2 emission of approx. 644 kg CO2/MWh (PSMP forecast) for a typical mix of power plants consisting of coal, gas, and diesel is assumed.

On average 1265 MWh/substation loss reduction each year can reduce energy loss by 1265 x 168nos. substation = 212520 MWh.

Therefore, the reduction of CO2 emission due to the loss reduction of 212520MWh can be estimated for 168 nos. substations as (212520 MWh x 644 kg/MWh) = 136862ton CO2. [9] [14]

The reduction of CO2 is 136862-ton CO2 per year by this completed project.

RM-Pole Mounted S\S

- Will reduce CO2 after its completion.
- *Estimation of the reduction in CO2 emission resulting from lower losses in the power system as follows:*

A CO2 emission of approx. 644 kg CO2/MWh for a typical mix of power plants consisting of coal, gas, and diesel is assumed.

Therefore, the reduction of CO2 emission due to the loss reduction of 29,106MWh can be estimated for 23 substations as (29,106 MWh x 644 kg/MWh) = 18,744ton CO2

The reduction of CO2 is 18,744 tons CO2 per year. [10] [14] [15]

4.2.3 Renewable Energy Practices

Energy from renewable natural resources is energy that is produced more quickly than is used. Examples of such sources that are continuously replenished are sunlight and wind. There are many renewable energy sources available to us.

4.2.3.1 Renewable Energy Practice as Sustainable Supply Chain Practice

Today, sustainable energy is important for a variety of reasons. Below are a handful of them:

We can become less dependent on fossil fuels possibly even completely by using sustainable energy sources. The most widely used energy sources are not sustainable yet. The cleaner energy and renewable energy we demand to power our world, the less fossil fuels we will need in the long run. Although they are currently dependable and easily accessible, fossil fuels won't always be so. There is always room to grow our reliance on safer and healthier energy sources because there is at least one type of sustainable energy that can be produced somewhere in the world.

There is no end to the supply of renewable energy. Using nonrenewable resources exclusively serves to postpone the inevitable. We will run out of resources sooner and the harm to the planet

will be more severe, if not permanent, if we keep depending so heavily on limited resources. Fortunately, if the wind blows, the sun shines, and the tides come in, resources like wind, solar, geothermal, and hydropower will continue to supply us with energy.

Sustainable energy can enhance public health while posing no harm to the environment. Greenhouse gas emissions from renewable energy sources are negligible or nonexistent, improving both the environment and human health. Fossil fuel pollution irritates our lungs and can cause respiratory disorders and lung diseases. The environmental benefits of sustainable energy also relate to the cost-benefit aspect of our energy consumption. Eventually, renewable energy will prove to be the more cost-effective choice. Every year, renewable energy sources like solar and wind power get much more affordable. They will probably be on par with non-renewables globally in a decade or less.

4.2.3.2 Findings of Renewable Energy Practices for the Two Selected Projects

BREB is a public organization that distributes electricity to rural consumers and is implementing the government rules of solar panel installation during the electricity connection. Bangladesh Government already approved the new solar road map and BREB is the largest stakeholder to implement it. Today it is mandatory for commercial and industrial consumers to set up a solar system installation on their property's rooftop. In the two selected projects, the usage of solar panels is of great importance.

DNE-DMCS

- Serving electricity to the 17,10,000 Nos. of consumers ensuring a solar system installation according to the government guidelines.

Confirmation of solar installation before providing the electricity connection. [8] [9]

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- The Project Director and related field officials will make sure first the solar connection before providing the electricity. [11]

4.2.4 Environmental, Social, Health & Safety Practices

Environmental concerns are now national priorities as well as worldwide issues. The goal at the sub-regional, regional, and international levels is to recognize the value and advantages of environmental conservation for sustainable growth.

Although economic growth, industrialization, and better technology have all had a positive impact on man's quality of life, the world is still headed in an unsustainable direction, which has had negative effects on the environment. But in addition to the natural ones, a wide range of environmental issues have emerged, posing a threat to human health and the ecosystem they depend on.

Thus, a balance between technological advancements that enhance human well-being and those that have the least negative impact on our land, water, air, and biodiversity is required. Since the precautionary principle ensures that any technological development is done with due consideration to our environment, it serves as an antidote to this.

A comprehensive system of guidelines, protocols, and industry standards known as Environment, Social, Health, and Safety (ESHS) practices has been created and put into place to manage ESHS risks and hazards associated with the development project's construction activities. As a result, the ESHS handles every task about overseeing the development project's operation phase.

4.2.4.1 ESHS Practices as Sustainable Supply Chain Practice

Environment, social, health, and safety practices are crucial in sustainable supply chains for several reasons:

Environmental Impact: By incorporating environmentally responsible practices, supply chains can minimize resource depletion, reduce pollution, and mitigate the impact of production and distribution processes on ecosystems. This helps in preserving the environment for future generations.

Social Responsibility: Prioritizing social practices ensures fair treatment of workers, adherence to labor laws, and protection of human rights. This contributes to building a positive reputation, attracting socially conscious consumers, and fostering a positive relationship with employees and communities.

Health and Safety: Ensuring the health and safety of workers is fundamental to ethical business practices. Safe working conditions not only protect employees but also contribute to increased productivity, reduced turnover, and overall organizational stability

Legal Compliance: Many countries have regulations governing environmental protection, labor practices, and health and safety standards. Adhering to these regulations helps companies avoid legal issues, fines, and reputational damage.

Risk Mitigation: Embracing sustainable practices mitigates various risks, including supply chain disruptions due to environmental disasters or social unrest. A resilient and sustainable supply chain is better equipped to handle unforeseen challenges.

Consumer and Stakeholder Engagements: With increased awareness and concern for sustainability, consumers and stakeholders increasingly expect businesses to operate responsibly. Meeting these expectations can enhance brand value and customer loyalty.

Long-Term Viability: Sustainable practices contribute to the long-term viability of a business. They help in building resilience against environmental and social challenges, ensuring stability and continuity in a rapidly changing global landscape.

In summary, integrating environmental, social, health, and safety practices into supply chain management is essential for ethical business conduct, legal compliance, risk mitigation, and long-term business sustainability.

Realizing cross-generational and intra-generational development that impacts a balance between ecological, social, and economic needs is still a long way apart for the world community. Therefore, requiring Environmental Impact Assessments (EIAs) for all development projects is the best way to take action. The International Association for Impact Assessment (IAIA) defined EIA as the process of identifying, predicting, evaluating, and mitigating the biophysical, social, and other pertinent effects of development proposals before making significant decisions or making commitments. The process of methodically identifying, forecasting, assessing, and mitigating the effects of development proposals is known as an environmental impact assessment, or EIA. This helps the appropriate authorities make decisions about how worthy the proposals are. The biological, physical, social, and safety aspects make up the majority of the impacts that are evaluated. [14] [16]

In BREB, all the projects either from GoB or Development partner's investment, it is mandatory to attach the NOC from the DoE. These tasks are done by the BREB's own Environmental Department. During project period every year for each project, this department assesses the EIA again and fill the form of DoE and pay the fees. By arranging a visit from the DoE, the renewal of NoC is issued again each year and also after the completion of project.

4.2.4.2 Findings of ESHS Practices for the Two Selected Projects

DNE-DMCS

- "No Objection Certificate" from the Department of Environment, Bangladesh was issued sequentially after the EIA report was done.
- No physical causalities were seen during the project implementation because safety was ensured in every construction work.
- Social awareness was conducted in rural areas by forming several executive committees by government officials.
- Rehabilitation procedures were successfully done according to the government guidelines.
- Sustainability Guidelines and Guidelines on Incorporating Human Rights Standards and Principles, including Gender; WBG Environmental and Social Operational Policies; and WBG General EHS Guidelines have been followed. [14]

RM-Pole Mounted S\S

- Expected to reduce indoor air pollution by replacing kerosene and firewood with electricity as an energy source for lighting.
- Will reduce the use of diesel as an energy source for pumping, agriculture processing, light industry, and commerce and service delivery.
- The safety guidelines are prepared by an international consultant.
- Separated re-habilitation procedures are also prepared for this project.
- Social incorporations from the stakeholders will be ensured by an individual guideline from KFW-German. [15] [17] [16]

4.2.5 Sustainable Procurement Practice

Purchasing goods, services, or labor while taking the environment, society, and economy into account is known as sustainable procurement. Making decisions that promote social responsibility, reduce harmful effects on the environment, and enhance long-term economic viability are all part of it. Along the whole supply chain, this strategy seeks to advance sustainable practices, moral work practices, and ethical labor standards.

4.2.5.1 Sustainable Procurement as Sustainable Supply Chain Practice

Sustainable procurement involves integrating environmental, social, and ethical considerations into the procurement process. Key elements of sustainable procurement practices include:

Environmental Consideration: Consideration of the environmental impact of products and services, such as energy efficiency, carbon footprint, and use of sustainable materials.

Social Responsibility: Ensuring suppliers adhere to fair labor practices, human rights standards, and ethical business conduct.

Ethical Sourcing: Promoting transparency in the supply chain, preventing the use of child labor or unfair working conditions, and supporting fair trade practices.

Local Sourcing: Prioritizing local suppliers to reduce transportation-related emissions and support local economies.

Life Cycle Assessment: Evaluating the entire life cycle of products, from raw material extraction to disposal, to assess and minimize overall environmental impact.

Supplier Diversity: Encouraging a diverse supplier base, including small and minority-owned businesses, to promote inclusivity and support a variety of stakeholders.

Circular Economy Practices: Embracing strategies to minimize waste, encourage recycling, and promote the circular use of materials in product design and manufacturing.

Continuous Improvement: Regularly assessing and improving procurement practices to align with evolving sustainability goals and industry standards.

Sustainable procurement aims to balance economic, environmental, and social considerations, contributing to a more responsible and resilient supply chain. It reflects a commitment to long-term sustainability goals, ethical business practices, and positive contributions to the broader community and environment.

4.2.5.2 Findings of Sustainable Procurement Practice for the Two Selected Projects

BREB has implemented and is currently implementing various types of projects depending on the mode of financing. The terms of the contract between the implementing agency (BREB) and the development partner determine this mode. When ADB, World Bank, JICA, KOICA, AFD, KFW, GIZ, IDB, and other development partners are involved, they have contracts that require them to adhere to their procurement policies. Otherwise, the GoB-funded projects adhere to PPA-2006 and PPR-2008. The approved guidelines, which include PPA and PPR, are created to guarantee procurement transparency, the best competitive bidding, the highest level of expertise, the best quality products, and precise design and implementation works.

DNE-DMCS

- Followed the PPA-2006 & PPR-2008 for all the procurements.
- 138 nos. packages of Goods as electrical materials, Works as EPC of substations, river-crossing tower, switching stations, and civil works were successfully executed by following PPA-2006 & PPR-2008.
- A total of 1200 nos. of line construction packages were executed with 44 nos. of consultancy service packages.

This mega project is a clear example of legal requirement of procurement practice which ensured a sustainable supply chain at the national level. [8] [9]

RM-Pole Mounted S\S

- Being carried out following the internationally recognized KFW procurement guidelines for consultancy services works for substation up-gradation and line up-gradation in the EPC manner.
- It will guarantee all the elements such as social responsibility, ethical sourcing, local and regional sourcing, diversity of suppliers, life cycle assessment, circular economy practices, and continuous improvement. [10] [14]

Chapter 5

Challenges and Mitigations in the Implementation of Sustainable Supply Chain Practices in BREB

Implementing a sustainable supply chain in the power sector can be challenging due to various factors. Here are some of the key challenges:

Regulatory and Policy Framework: The power sector is robustly managed, and the current regulatory and policy framework structure may not dependably boost or back maintainable practices. The absence of clear rules or conflicting guidelines can hamper the reception of feasible measures.

High Initial Costs: It is sometimes necessary to make a substantial upfront investment in new infrastructure, technology, and training to implement sustainable practices. These robust upfront expenses may be met with resistance from other power industry companies, particularly if the benefits take time to materialize.

Technology Transition: The replacement or modification of current infrastructure may be necessary to make the transition to sustainable technologies and energy sources. The potential for disruption and resistance decreases from hesitations over technology developments' financial outcomes, performance, and reliability.

Supply Chain Transparency: For sustainability initiatives to be successful, supply chain transparency must be achieved. However, the length and complexity of supply chains in the power sector can make it challenging to track down the source of resources and guarantee that they adhere to sustainability criteria.

Globalization and Outsourcing: Many businesses in the power sector get materials and components from throughout the world. It is difficult to maintain supply chain sustainability

when working with suppliers from various geographical areas who have diverse social and environmental standards.

Interconnected Risks: The power sector is susceptible to several hazards, including economic, geopolitical, and climate-related uncertainty. Because of these interrelated risks, firms may find it more difficult to implement sustainable supply chain strategies since they must maneuver through a changing and unpredictable environment.

Collaboration and Engagement: Reaching sustainability objectives frequently requires cooperation between many diverse stakeholders. Because suppliers, manufacturers, and consumers have different objectives and interests, it can be difficult to establish efficient systems for communication and interaction.

5.1 Challenges and Mitigations of the Completed Project

Challenges and Mitigations of the completed project titled “Distribution Network Expansion for 100% Rural Electrification (Dhaka, Mymensingh, Chittagong & Sylhet Divisions) 2nd Revised” are discussed as

1. The original DPP of this project was prepared in light of the feasibility study for the expansion of the distribution network and a master plan that time in 2017. Following the 'Vision-2021' of the Government of Bangladesh, the “completion of 100% Upazilla-based electrification program” adopted by BREB was underway. According to the vision, a decision was taken to bring every household under electricity connectivity in un-electrified areas including off-grid areas. [8]

Mitigation: To make this program a success, BREB had to connect consumers in most of the newly developed settlements/ marginal settlements of remote areas, industrial establishments, economic zones, and settlements of various pastures of off-grid areas through grid power to elevate socio-economic development in the project areas. [9]

2. The conventional design of BREB was not applicable to connect every lifeline consumer by using the allotted electric materials and substation that were in the 1st DPP after getting the exact staking sheet from the field consultant. [8]

Mitigation: In most cases, 1 or 2 poles were required to connect the marginal/ newly emerging consumers and all these lines were close to the line. To bring every household under electricity connection there was a need for an additional 8,740 Km distribution line, 8 nos. new outdoor substations (80 MVA), and augmentation of 3nos. existing substations (30 MVA) to connect an additional 3.40 lac new consumers in the project areas. BREB made a way forward by changing their designs for line construction and substations. Finally, the Government of Bangladesh increased their investment according to the BREB's sustainable design practice. [9]

3. In the 1st DPP there was a provision to construct 61 nos. new Substations with land acquisition. Out of 61 nos. substations, the land of 9 nos. substations had been provided by its source, land of 18 nos. sub-stations acquired in that time, and the remaining 34 lands needed longer time to acquire than as usual time. [8]

Mitigation: As BREB is an electricity distribution authority, they have their funding sources by selling electricity to the consumers. When it was seen that the project facing some delays because of land acquisition, BREB changed its mode of financing by investing its funds and directly bought some land from the land owner for the project rather than following government land acquisition method. In that case, they followed a perfect resource practice and proved a sustainable supply chain. [9]

4. Almost every river crossing tower construction work had to face roadblocks from local landowners and taking a long time to clear the roadblocks. Besides this, the construction site of the tower is on the river bank, and the overall progress (Piling/ Tower Foundation works) at

the field level on the river bank is hampered due to the work of the tower foundation being stopped during the rainy season and adverse weather. [8]

Mitigation: By managing the stakeholder's incorporation in the development works by offering various working opportunities in the development works as direct or indirect participation from the rural people. Involving local government representatives from all the departments, the project office made the working environment and finally, the contractor completed the river crossing tower. [9]

5. The whole of Bangladesh had been locked down from 26th March 2020 to 30th May 2020 and thereafter to prevent the outbreak/spread of the global COVID-19 virus. Overall progress of the project had been hampered by a lockdown in the entire Bangladesh due to the global outbreak of the COVID-19 virus, lack of supply of construction materials due to the coronavirus, and the Russia-Ukraine war. As a result, construction works (construction of distribution Lines, construction of new sub-stations, construction of Towers, and construction of Civil works) as well as procurement of goods were closed and it was not possible to complete the construction tasks t in time. [8]

Mitigation: Making a healthy working environment within a healthy cluster of construction sites some development tasks were done but considering the worldwide outbreak of COVID-19, BREB & Government of Bangladesh finally extended the project duration and also the construction duration without penalizing the contractors and suppliers. This central government decision supported the development contractors and suppliers. ESHS were then revised by considering COVID-19 and a good sustainable supply chain was practiced. [9]

5.2 Challenges and Mitigations of the Ongoing Project

Challenges and Mitigations of the ongoing project titled "Renovation and Modernization of Existing 33/11 kV Wooden Pole Mounted Substations in BREB (Phase-I)" are discussed as

1. Project Design and Supervision Consultant recruitment has been re-tendered due to a high bid of more than 100% (twice) of the DPP price. It has already taken 9 months in the 1st phase of this tendering. All the scope of the work must be completed within the project's approved duration. It is the only challenge for this newly ongoing project. [14]

Mitigation: By following the development partner's international procurement guidelines, the project office and development partner make some changes in bidding documents to minimize the time that will be taken by the consultant to submit the drawings and design of the lines and sub-stations. Sustainable procurement practices are adopted for this supply chain. The international re-tender is already floated and within 2-3 months the consultant will be on board. The project is expected to run smoothly within the project duration.

No other issues are seen in this ongoing project.

Chapter 6

Conclusion

The Bangladesh Rural Electrification Board's development projects incorporate several theoretical contributions to sustainable supply chain practices, which are highlighted in this report. It is primarily the first literature review to use a systematic approach to analyze the body of literature on SSCP with an emphasis on Bangladesh's development project and BREB for environmental and social sustainability. Second, this report offers a thorough conceptual framework that integrates measures, barriers, mechanisms, and results for sourcing development products from suppliers, contractors, and experts in developing economies and providing consumers with sustainable products like electricity through the use of sustainable supply chains. Measures within this framework are categorized based on the foundations of institutional theory. New strategies for analyzing barriers during the implementation of a sustainability effort are provided by the separation of ex-ante and ex-post barriers. A thorough framework for future analysis and reference is provided by classifying development activities and practices based on their mandatory or collaborative nature and including economic, social, and environmental outcomes. Finally, additional future analysis is suggested for academics to address in the future based on the findings of the BREB's sustainable supply chain practices in the development projects, the literature review and methodology of this report, and more.

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Appendix A.

Group A: Sample Interview Questions for Completed Project

1. What is the initial project detail?
2. What were the sustainability measures followed in the project?
3. What were the challenges faced by the Project Implementation Management Unit (PIMU)?
4. What were the initiatives to solve the raised problems?

Group B: Sample Interview Questions for Ongoing Project

1. What is the initial project detail?
2. What will be the sustainability measures followed in the project?
3. What is the plan to achieve the targeted sustainability in the supply chain?