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"INTRODUCTION OF GREEN SUPPLY CHAIN TO DESCON (CONTSTRUCTION OF MOHMAND DAM PROJECT)"

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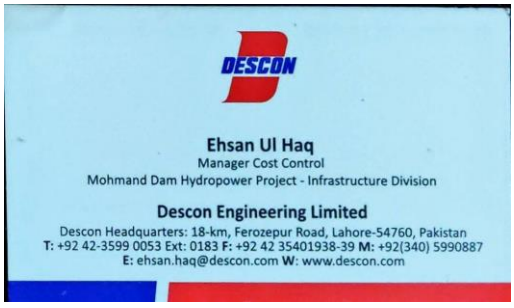
This is to certify that this project report, entitled "INTRODUCTION OF GREEN SUPPLY CHAIN TO DESCON (CONTSTRUCTION OF MOHMAND DAM PROJECT)" by ASIMA HAMEED (01-321202-025), HASSAN SAEED MALIK (01-321202-028), M. ARBAZ KHAN (01-321202-031), submitted in partial fulfillment of the requirements for the degree of Masters of Business Administration from Bahria University, Islamabad Pakistan, during the academic year of 2021-22, is a bonafide record of work carried out under my permission and guidance.

Designation: Manager Cost Control

Name of Project Organization: Descon Engineering Ltd.

Address: Mohmand Dam Hydro-power project



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ABSTRACT

Due to globalization world is now more connected than ever before. To stay competitive, firms need to come up with the new ideas in order to compete in the market and to satisfy the customers. Similarly, the supply chain plays an important role in the success of any firm. If the supply chain is well integrated, it means the firm can utilize resources more efficiently and reduce waste. In this regard the concept of green supply chain is now incorporated by the firms, so as to design the supply chain in such a way that it considers environmental issues and works on achieving sustainability. For the construction of dam, it is very important to save natural resources and minimize the pollution. Due to this, we have proposed a web portal to the Descon (contractor of Mohmand dam) that will help them to introduce green practices to their supply chain as well as it will help the employees at Descon to get the basic knowledge about green supply chain. This web portal also complies with the Sustainable Development Goals and will also help in improving the Environmental Performance Index (EPI) of Pakistan.

Our proposed solution for the Descon is a platform which includes all the features, 1) Green materials, (2) Green transportation, (3) Energy-efficient Warehousing, (4) Solar Panel Installation and (5) Reverse Logistics. This web portal will be user friendly, and all the guides will be available for beginners in the user manual provided. This portal will help Descon to introduce green supply chain which will not only help in sustainable development but also to gain a competitive advantage.

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1 Introduction:

With increase in the globalization and the advancement of the technology, the businesses are not only focusing on integrating technology into their operations but also are reviewing their operations and supply chains. This is due to increased pressure from customers regarding environmental issues, increased enforcement of regulations from government and non-government organizations on the issue of safety and sustainability of the environment. Green supply chain management integrates of supply chain management with environmental requirements at all stages of product design, selection and supply raw material, production and manufacturing, distribution and transmission processes, delivery to the customer and after consumption processes such as recycling and reuse management in order to maximize the amount of energy and resource efficiency, along with improved performance of the entire supply chain (Olfat, Khatami-Firouz & Khodaverdi, 2011). With increasing concerns on quality and supply chains in the 1980s and 1990s respectively, businesses were led to take into consideration the concern of environmental sensitivity. Kelle and Silver (1989) were among the researchers who examined green supply chain management as an applied issue and proposed a system for the products that are potentially reusable for the organizations. For the first time, Navin-Chandra (1991) proposed that in order to reduce the negative impact product wastes have on the environment, there is a need to introduce green design concepts for the products. Then Ashley (1993), Allenby and Richards (1994), Zhang, Kuo, Lu and Huang (1997) have developed green design.

When we talk about green supply chain management, one of the concepts that is important to consider is the Waste Management. Roy and Whelan (1992) were the first researchers who have worked in this field. They knew the importance of waste reduction, and therefore, proposed a model that would help in reducing the electronic waste. Green Supply Chain are all the firm's actions (whether they be internal or external to the organization) that would help in the sustainability of the environment and mitigate pollution. In other words, green supply chain management includes green purchasing, green production, green distribution, green marketing, and reverse logistics.

Reverse Logistics involve all the parties involved in the supply chain, from the manufacturer to the end user, to play their part and try to reduce the harmful effect of their action the surroundings and therefore, sustaining a green environment. The managers of green supply chain in leading companies are trying to use green logistics and satisfaction by creating environmental perspective throughout the supply chain, improving the environmental performance in the entire supply chain as a strategic weapon for gaining competitive advantage and founded they objectives on three important topics: green design (product), green manufacturing (process) and recycling products, (Boks & Stevels, 2007).

The focus of this project is to develop a web portal for Descon that would help the organization (initially in the construction of the Mohmand Dam) to introduce some of the aspects of 'Green' into their supply chain as well as it would serve as a two-way communication between the organization and its stakeholders (both the employees and the employers) to gain from the portal and serve it with their expertise.
This web Portal will be based on two phases:

- Proposing a Web Portal in which the solutions would be provided to ensure Green Supply Chain Management (if not completely, then partially).
- A two-way approach that would help the employees to learn about the basics regarding Green Supply Chain (if not already known) and on the other hand, to take benefit from the Professionals to suggest how the supply chains can further be improved.

Figure 1: Construction Site of Mohmand Dam

Descon is one of the Pakistan's leading engineering organizations, with its expertise in different sectors like Oil & Gas, Cement, Power, Hydro Power, Dams/Barrages/ Canals, Fertilizer, Renewable Energy, Sugar, Industrial, Chemical and Petrochemicals. Not only this, but they are also well-known in the EPC, Construction, Maintenance/Industrial Services, Infrastructure, Manufacturing, and Automation & Control projects. Descon has not only shown its expertise in Pakistan but is also present globally in different countries like Kingdom of Saudi Arabia, UAE, Kuwait, Qatar, Oman, Iraq, South Africa & Kenya. WAPDA assigned the contract for the construction of Mohmand Dam to Descon. The agreement was signed on 26th March 2019. Following are the details of Work-in Progress of Mohmand Dam as mentioned by WAPDA:

Description	Progress (%)
Permanent Access Roads	52.69%
Project Colony:	30.46%
Re-Regulation Pond	19.33% Excavation Completed
Diversion & Access Tunnel	20.78%
Spillway	7.59%
Power Intake and Main Dam	0.05%
Irrigation Tunnels	• Work on temporary access road to Inlet Portal of Left Bank Irrigation Tunnel is in progress. • Contractor has started excavation and slope stabilisation of Inlet Portal of Left Bank Irrigation Tunnel
Drilling Works	Drilling work is in progress.

Figure 2: Table shows Work Progress at Mohmand Dam.

1.1 Project Objectives:

Following are the objectives of the Web Portal proposed:

1. To propose a multi-functional web portal providing green supply chain solutions to Descon (specifically for the Mohmand Dam Project).

2. To propose a function (within the portal) which could provide the basic know how of green supply chain management as well as the portal to the unskilled employees of the organization.
3. To propose a two-way communication system between the organization and its stakeholders.
4. To help the organization in order to maximize the efficiency of its supply chain.
5. To propose a web portal that helps in attaining the Sustainable Development goals.

1.2 Project Goals:

The goal of this project is to propose a web portal for the Mohmand Dam construction project of Descon that will serve them multiple purposes. The analysis done by us (especially the cost-benefit analysis) coincide with our proposal and align with our goals and objectives. Also, it will help us to understand the construction industry and their requirements. Therefore, we have proposed to develop a Web Portal that is not only user-friendly but also flexible enough to be customized according to the requirements.

1.3 Anticipated Benefits:

According to our research, we expect that with the implementation of this web portal, Descon will gain a competitive advantage over their competitors, their brand image will be improved, and better employee performance would be seen (as basic learning of green supply chain will be provided in the portal). This Portal brings in a hope of reducing the wastes at the construction sites, reducing the carbon emissions, making those areas energy efficient, and most importantly, making construction environment-friendly, leading it towards sustainability. Descon, with the introduction of this Web portal, will be considered as the pioneers to be working on green supply chain which can also set an example for other industrial sectors regarding how green and environment-friendly practices should be adopted by them.

1.4 Key Success Factors:

The major key success factors for this project are as follows:

1. Eco-friendly environment because of the green practices adopted in the supply chain as well as other business operations by the organization.
2. Positive feedback by both the stakeholders (the employees as well as the employers).

3. Accomplishment of the Sustainability Goals as well as implementation of the environmental protection laws.

1.5 Estimated Time Frame:

Total duration of this project is 03 months from November to January.

1.6 Constraints:

Every problem is an opportunity but to grab that opportunity, there always lie some limitations. It is critically important to minimize the scope of limitations through the process of proposing new solutions so that the business operations run smoothly.

1.6.1 Limited Sector

This proposed web portal only targets one of the industrial sectors i.e., construction industry. Due to limited resources and access we couldn't survey other sectors where this web portal could prove to be beneficial and profitable.

1.6.2 Time Constraint

Due to time constraint, it was difficult for us to undertake an in-depth analysis of the organization and their processes so as to provide further green practices for their supply chain.

1.6.3 Distance and Security Constraint

Due to long travelling distance to Mohmand Dam construction site, repetitive visits were not possible to collect detailed information. Also, due to security issues, we did not have the opportunity to visit the site time and again.

1.6.4 Patents

Patents are very important for new product and ideas. As our web portal is an innovative solution in the construction market it requires patent protection. By doing this we can deter new competitors arising in the market and copying our portal.

1.6.5 Prototype:

As our web portal is in its initial stages of development, and there is much scope of improvement in it therefore, currently, it would only work in online mode i.e., it would not work without internet service. The system will not work on Google Chrome with Version less

than 94.0.4606.81. The system will not work on Microsoft Edge with Version less than Version 96.0.1054.53.

1.6.6 Lack of Awareness

We as a nation, are not open to out of the box initiatives especially when it comes to the environment. Although with increase in globalization and raise of voices regarding climate change and environmental issues on international forums, people are now thinking more of the environmental protection initiatives.

When Descon will introduce this web portal at first the management of the organization will have to create awareness about it among its employees in order to perform their business operations effectively and efficiently. Green Supply Chain Management is a new concept yet once implemented it will prove to beneficial for the country. Initially we will face difficulty in changing the mindset of people and replacing the traditional supply chain with green supply chain.

1.6.7 Limited Resources

One of the biggest limitations in the construction of dam is that there are possibly no alternatives for the construction materials. This is because of the function of Dam where even a minute modification can cause the dam to disrupt. therefore, Due to limited resources available as alternatives (not strong enough to hold the giant structure of dam) it was not feasible to construct dam to use materials other than specified materials for the function.

2 Overview of the Construction Industry:

The global construction market is continuously improving moderately with the global economy showing a slight decline. In the longer run, it can be seen that the global construction market is showing positive increase and improvement and we can expect that it would grow above the Global Gross Domestic Product (GDP) in the upcoming decade.

Factors that influence this growth include population explosion, advancement in the infrastructures, trends in the residential development, the expected investments in the renewable energy resources and telecommunications, and most importantly, the increased environmental and sustainability concerns.

It can be seen from the world trends in the construction industry, that Pakistan's construction industry in lagging behind in the field of improved sustainability and green supply chain concepts. Therefore, Pakistan's construction industry needs to be improved to not only compete in the national market but also globally.

Not only the Global overview states the importance of sustainability and environmental protection, the condition of Pakistan on the Environmental Performance Index also indicates the improvements required for sustainable growth.

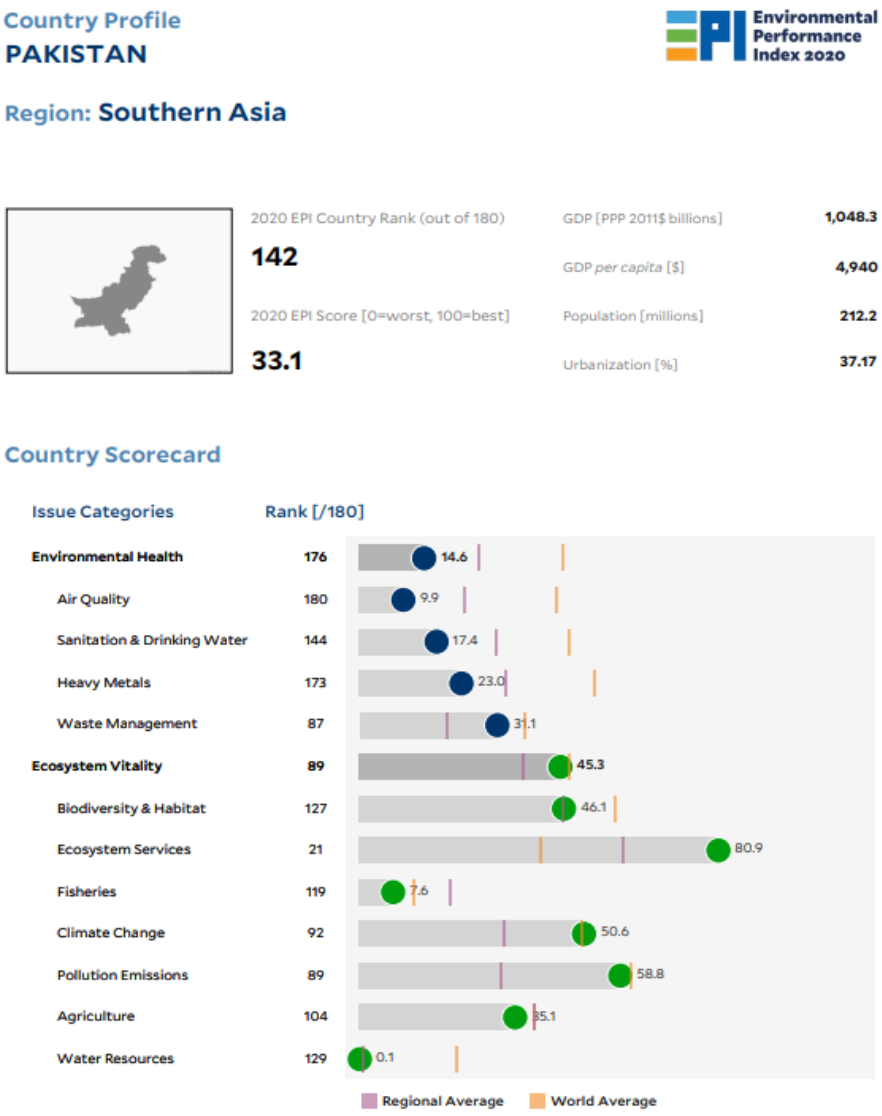

Figure 3: Scorecard of Pakistan in the Environmental Performance Index (EPI).

The Environmental Performance Index (EPI) is a method of quantifying and numerically marking the environmental performance of a state's policies. According to this index, the current situation of Pakistan is worse in terms of Environmental health and ecosystem vitality issues. This index shows that Pakistan is ranked 142nd out of a total of 180 countries.

In the recent years, the government has shown increased interest in the Construction Industry, causing a boom in this sector. Now, not only the construction of buildings and housing societies are increasing many folds, but also the construction of dams is taken into consideration. Prime Minister of Pakistan, Imran Khan states his target mission of constructing 10 dams by the end of 2028 to ensure food security, flood mitigation besides producing cheap electricity. This would also help to produce 08 million acres of cultivable land for Pakistan.

Now, as the construction is increasing, it is also important to cater with the environmental issues pertaining the construction industry. Considering all the above facts, with our proposed solution of Web Portal to Pakistan, our main focus is to develop Web Portal in which the solutions would be provided to ensure Green Supply Chain Management and Sustainability (if not completely, then partially).

2.1 Sustainable Development Goals and Sustainable Construction:

Sustainable development is defined as:

'*Economic development that is conducted without depletion of natural resources*'.

The sustainable development goals not only focus on eradicating poverty and ensuring peace in the world, but one of their utmost focus is to save the environment from the impacts of the man-made things. Now if we specifically talk about the construction industry, it immensely contributes to pollution and waste generation. Keeping this in view, the concept of Sustainable Construction has also been introduced. It aims at developing structures that:

- Maximize the use of sustainable resources while causing less pollution and waste.
- Improve the quality of life of the people in the structure.
- Offer flexibility and allow for future changes.
- Support natural environments and habitats.

Keeping all these facts in mind, we have proposed a web portal that not only contributes to sustainable construction but also complies with the following Sustainable Development Goals:

- Goal 07: Ensure access to affordable, reliable, sustainable, and modern energy for all.
- Goal 09: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.
- Goal 11: Make cities and human settlements inclusive, safe, resilient, and sustainable.
- Goal 12: Ensure sustainable consumption and production patterns.
- Goal 13: Take urgent action to combat climate change and its impacts.

2.2 Industrial Analysis

2.2.1 SWOT Analysis

1. **Strengths:**

- **Innovative:**

Our Web Portal will be one of the pioneers in the construction market. It is innovative as currently there is no such web portal introduced in the construction industry in Pakistan. This would bring in an innovative and complete green supply chain solution for Descon's problem.

- **In alignment with Sustainable Development Goals**

Our web portal is in alignment with Sustainable Development Goals, specifically goal 7, 9, 11, 12 and 13. It is strength of our project as we will be supported by Government and NGOs for this cause.

- **Smart technology**

This portal is providing smart technology which can easily replace the traditional supply chains. Also, it is beneficial for all the sectors so it will prove to be profitable and beneficial.

- **Environmental Aspect**

In our proposed solution, we are considering the environmental aspect which will help us gain recognition and support in the market.

2. **Weaknesses:**

- **No patents**

Patents are very important for new product and ideas. As our web portal is an innovative solution in the construction market it requires patent protection. By doing this we can deter new competitors arising in the market and copying our portal.

- **Lack of Awareness**

We as a nation, are not open to out of the box initiatives especially when it comes to the environment. Although with increase in globalization and raise of voices regarding climate change and environmental issues on international forums, people are now thinking more of the environmental protection initiatives.

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operations effectively and efficiently. Green Supply Chain Management is a new concept yet once implemented it will prove to beneficial for the country. Initially we will face difficulty in changing the mindset of people and replacing the traditional supply chain with green supply chain.

- **Limited Resources**

One of the biggest limitations in the construction of dam is that there are possibly no alternatives for the construction materials. This is because of the function of Dam where even a minute modification can cause the dam to disrupt. therefore, Due to limited resources available as alternatives (not strong enough to hold the giant structure of dam) it was not feasible to construct dam to use materials other than specified materials for the function.

3. **Opportunities**

- **No direct competitors:**

It is an innovative idea and currently no company in the construction industry is working on such portal or green practices in Pakistan. We are providing a comprehensive plan for green supply chain management.

- **Large Target Market**

Green supply management system is a requirement of every industrial sector in every city of Pakistan which makes a large target market for our Web Portal.

4. **Threats:**

- **Competitors**

Currently we don't have patents for our product, so we are at risk of being copied by competitors.

- **Restrictions by Government**

Government laws might change in future and our activity might be restricted because of Local waste management company's pressure.

2.2.2 PEST Analysis

1. **Political**

Political factor plays an important role in construction industry, the rule and regulations forced to be followed by the government to the industry is one of the biggest barriers. If we talk about Pakistan, where there is political instability, it is one of the major challenges for green3. Green3 provides services commercially so it will be exposed to political factors and political risks. Following factors from political environment should be considered:

i. Political instability
ii. Tax rates
iii. Labor rights and regulations

2. Economic

The economic situation in Pakistan is not promising since interception. Economic factor basically includes the economy functions and the impact it has on the working of the company. Following factors from the economic environment should be considered by Green^3:

i. Economic system and environment of the country
ii. Inflation rate
iii. Labor and Production costs
iv. Disposable income

3. Social

Society's culture and way of doing things impact the culture of an organization in an environment. The attitude of the employees and their capability to accept the new technology should be taken into consideration in this regard. Social factors which Green^3 should consider in PEST analysis are:

i. Demographics
ii. Awareness on supply chain and sustainability
iii. Attitudes and interests of target market
iv. Health consciousness

4. Technological

Technology is revolutionizing day by day so a comprehensive technological analysis needs to be done in order to avoid risk and have a robust system.

v. New recycling techniques
vi. Waste management techniques
vii. Emerging technological advancements in green supply chain, waste recycling.

Figure 4: Diagrammatic view of the PEST Analysis.

3 Problem Definition and Requirement Analysis

3.1 Problem Definition:

Nowadays the whole world is working on different means to save the environment and to ensure sustainability. Construction industry is considered as one of the main sources of environmental pollution. If we specifically talk about the construction of dams, there is no second thought about the importance of building a dam, but the construction of the dam also releases enormous amounts of environmental pollutants. Pakistan is a country where the natural resources are already very scarce and where pollution is one of the serious problems causing the air quality to drop rapidly. In such a situation, if we will not consider green practices in the construction and every other industrial sector it means we are going to have a serious threat in the future in terms of sustainable development.

Green supply chain nowadays plays an important role not only for any organization itself but for the society as a whole. Green supply chain not only helps to reduce waste but also reduces environmental pollution. Similarly, for the Mohmand dam, which is already under-construction, the authority needs to introduce green supply chain management to reduce waste as well as to use resources in an effective manner to ensure lean manufacturing and processes. Mohmand dam construction project needs to adopt eco-friendly practices and materials in order to achieve maximum sustainability and turn out to be environmental-friendly.

3.2 Cause and Effect Analysis:

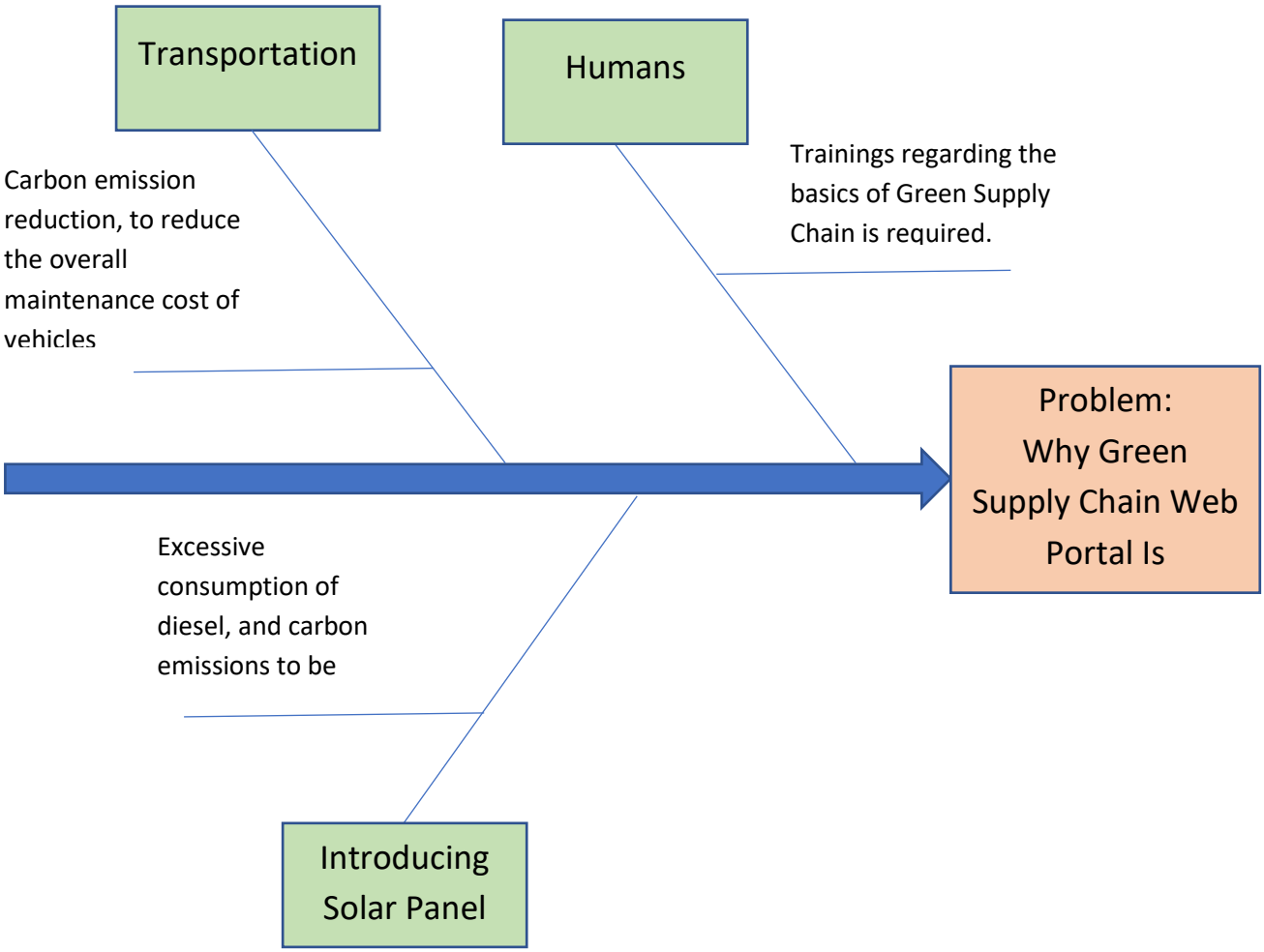

Figure 5: Cause and Effect Analysis

3.3 Proposed Solution:

Keeping in view the above statistics, our proposed solution is a Web Portal (Green^3) that is easy to use and implement by Descon (contractor of Mohmand Dam). The main motivation behind this portal is to provide different solutions to Descon that how they are going to adopt green supply chain practices. The portal is divided into different components that will help how to change traditional supply chain into green supply chain. We have developed a platform that will help Descon to identify the alternative green materials that would help them in construction of dormitories and the housing societies. In addition to this, this portal will help them to introduce different techniques that how can they change their transportation into green transportation. Furthermore, this portal will help them in reverse logistics that where they can

reuse and recycle the materials. Lastly, to reduce carbon emissions, the installation of solar panel is also proposed. This web portal is a blend of all good features that will help the Descon to manage their supply chain in such a way that it will be beneficiary for both the environment and the organization.

3.4 Advantages of the Proposed Solution:

1. The Web Portal will help them to reduce their production cost by using green materials.
2. Clean fuel (Euro III) will help them in reducing emissions from heavy machinery and other vehicles.
3. Airless Tyress will serve as a cost-effective alternative for Pneumatic ones.
4. Provides two-way Communication between top management and workers in implementing green construction.
5. The portal is user-friendly.
6. It will help to Accelerate sustainable development by minimizing wastes and resources.
7. Providing a single platform where detailed benefits of using green supply chain will be mentioned. It will also help to maximize efficiency.
8. Through this portal they can easily monitor the alternative inventory (green materials) available before converting it into final product which will be helpful in entire production process.
9. Energy Efficient Warehousing will also help in cost-reduction and ensure sustainability.

4 Design and Implementation:

4.1 Design of the Web Portal:

Following figures shows the design of the interface of the Green^3 Web Portal:

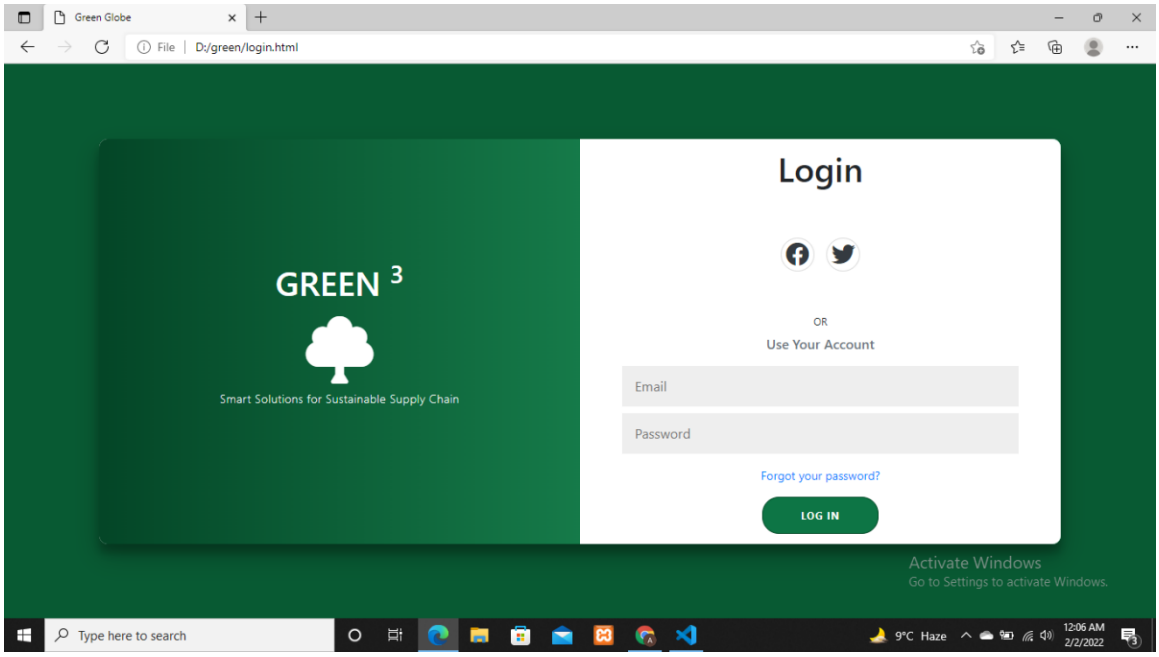

Figure 6: User Login Page

Figure shows the initial login page for Green^3 Web Portal. There are different login options available on the Initial page for an employee to choose from like you can login using your Facebook or twitter account, or you can also login using your email. As the employee logs into the page with the valid user credentials, they are redirected to next page, where the employee has the options to select from the given two options i.e., Login as Beginner or Login as Advanced user.

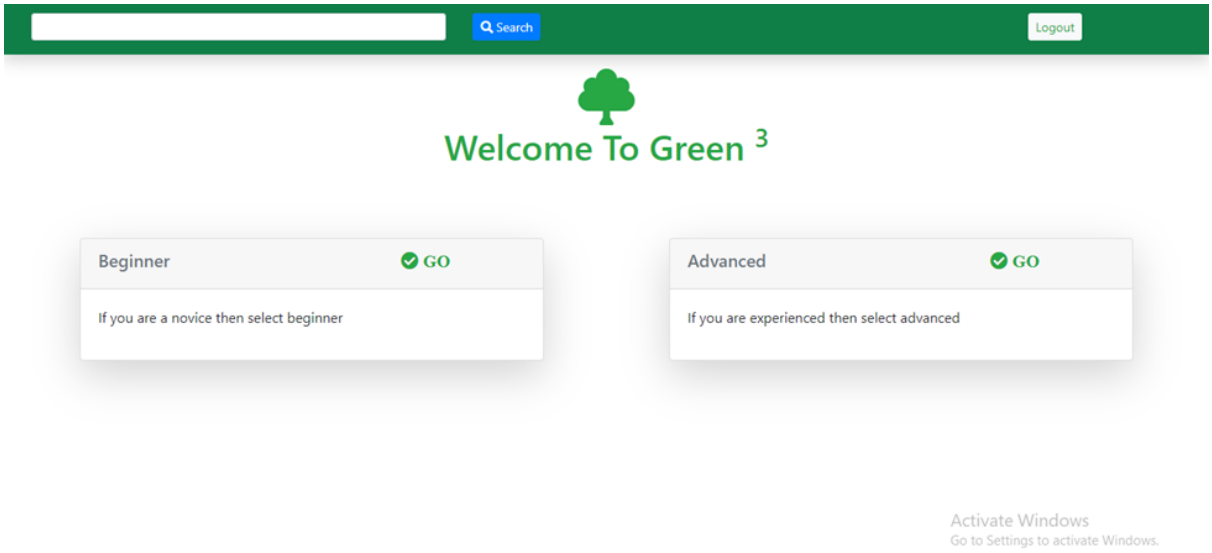

Figure 7: User Login Options: Beginner or Advanced.

Figure shows the options available for login. Following are the two options available:

1. Login as a Beginner: An employee with lesser experience or qualification, who does not possess the basic understanding of Green Supply Chain Management can login using this option. All the details related to the basics about how to use the Web Portal and Green Supply Chain Management will be mentioned in this section.
2. Login as an Advanced user: An Employee with more of professional experience and qualification, who has the knowledge about Green Supply Chain and can also share their expert opinions can directly login to the main section of the portal using this option.

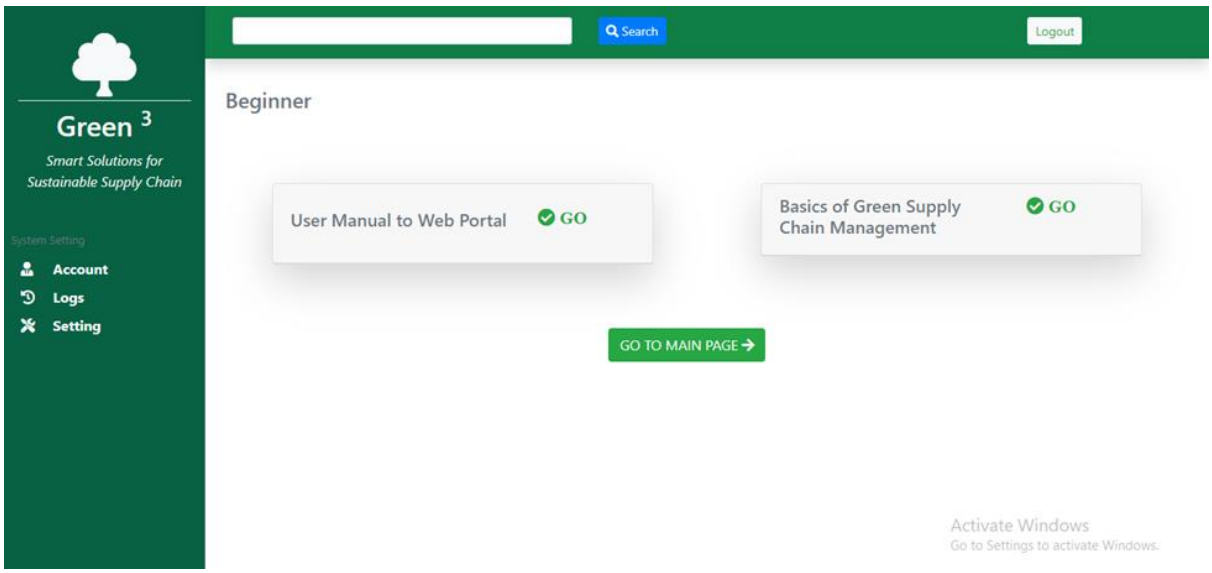

Figure 8: The Beginner Login Page of the Portal.

Figure 7 shows the Beginner Login Page of the Portal.

On this page, as it can be seen, two options will be available as mentioned below:

1. User Manual: In this option, all the basic information related to how the web portal can be used will be available which will help the inexperienced employees to learn about the basics of using the Web Portal.
2. Basics of Green Supply Chain Management: this option will help the employees to clear all their ambiguous thoughts related to sustainability and green supply chain management by providing all the basic information in this field.

This section will serve as a training for the fresh and inexperienced employees which will not only help them to increase their basic knowledge but will also keep them highly motivated. This awareness of Green Supply Chain Management will also result in better employee performance, and ultimately helping the organization to achieve their goals more effectively and efficiently. Users, who have completely learnt about the Web Portal and the Basics of Supply chain can move to the main page using the 'Go to Main Page' option.

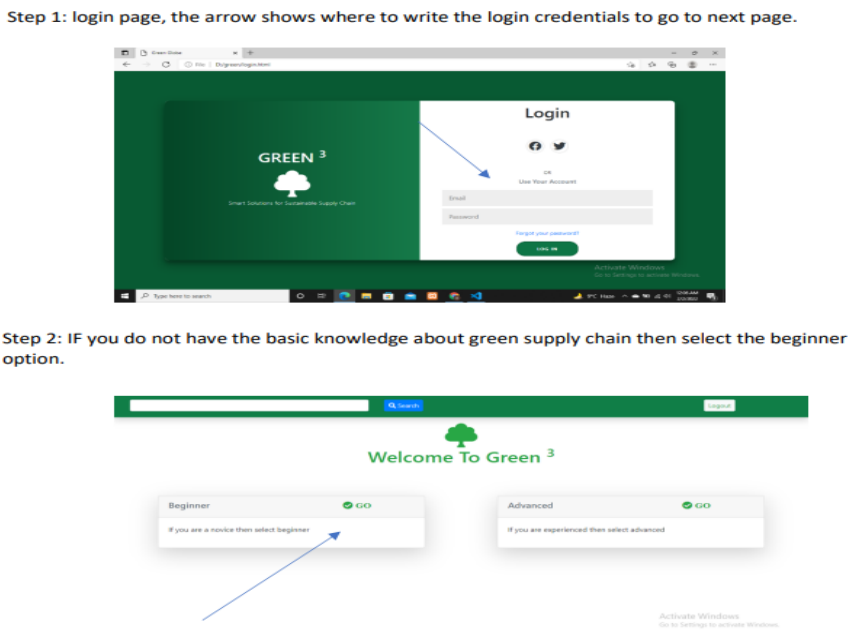

Figure 9: User Manual for the Web Portal.

Figure 8 shows the user manual for the Web Portal. On clicking on the user manual link, this diagrammatic manual will appear on the screen which will help the users regarding how to further use the Web Portal. It can be saved to the mobile or computer to be viewed later.

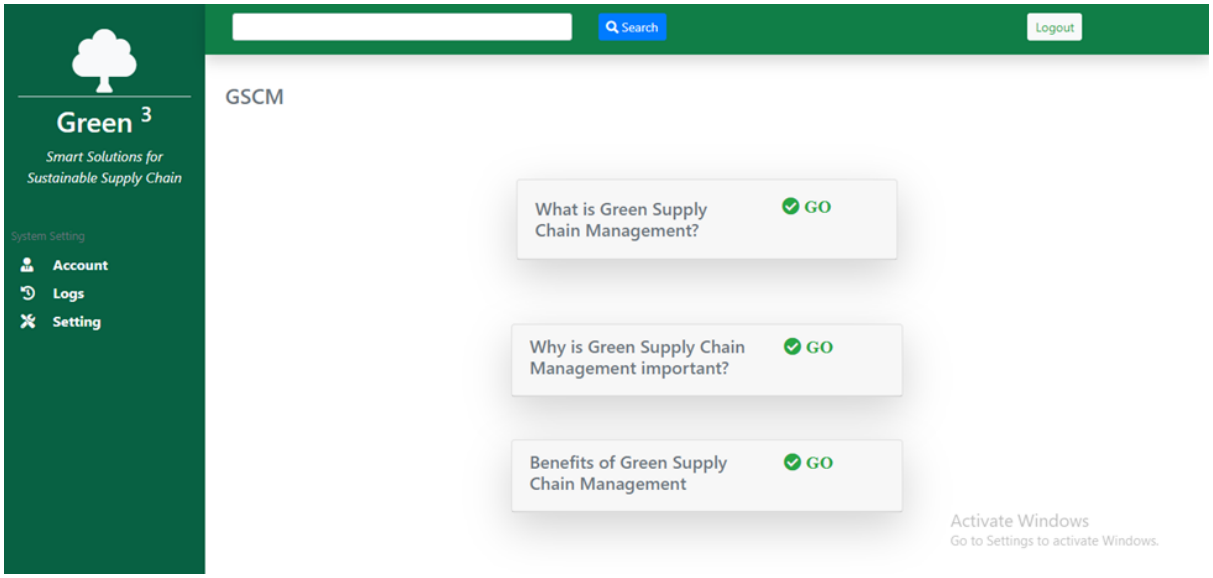

Figure 10: Basics of Green Supply Chain Management.

Figure shows the concepts of Green Supply Chain Management, like What is Green Supply Chain Management, why it is important and what benefits it brings to an organization.

Figure 11: Explanation of What is Green Supply Chain Mgt.

Figure shows the first concept to be known in the Basics of Green Supply Chain Management i.e., What is Green Supply Chain Management.

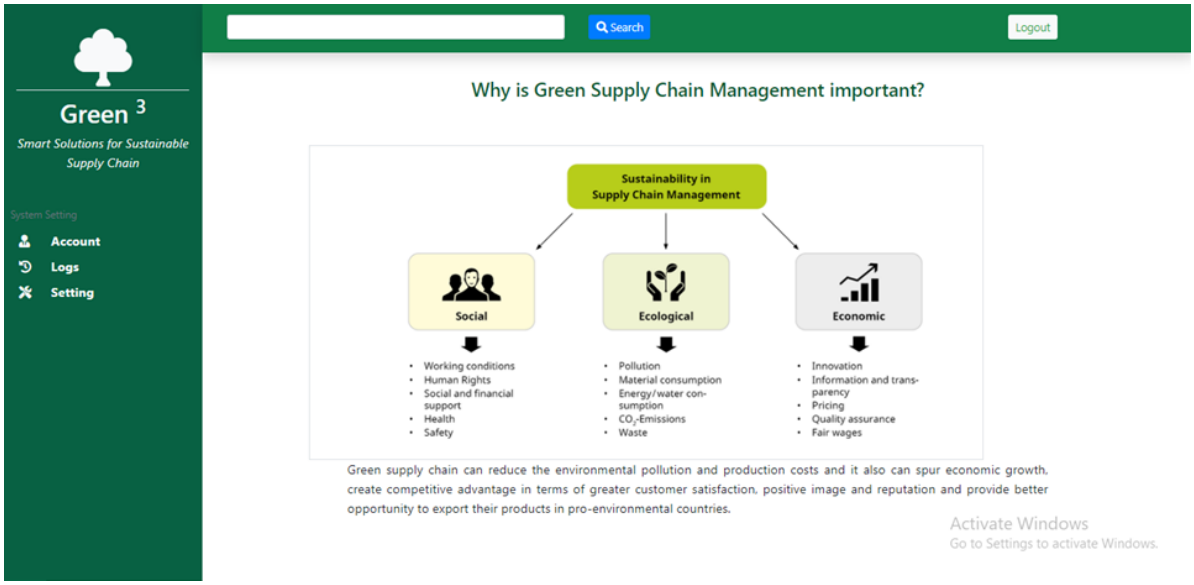

Figure 12: Importance of Green Supply Chain Mgt. explained.

Figure 11 shows the importance of Green Supply Chain Management.

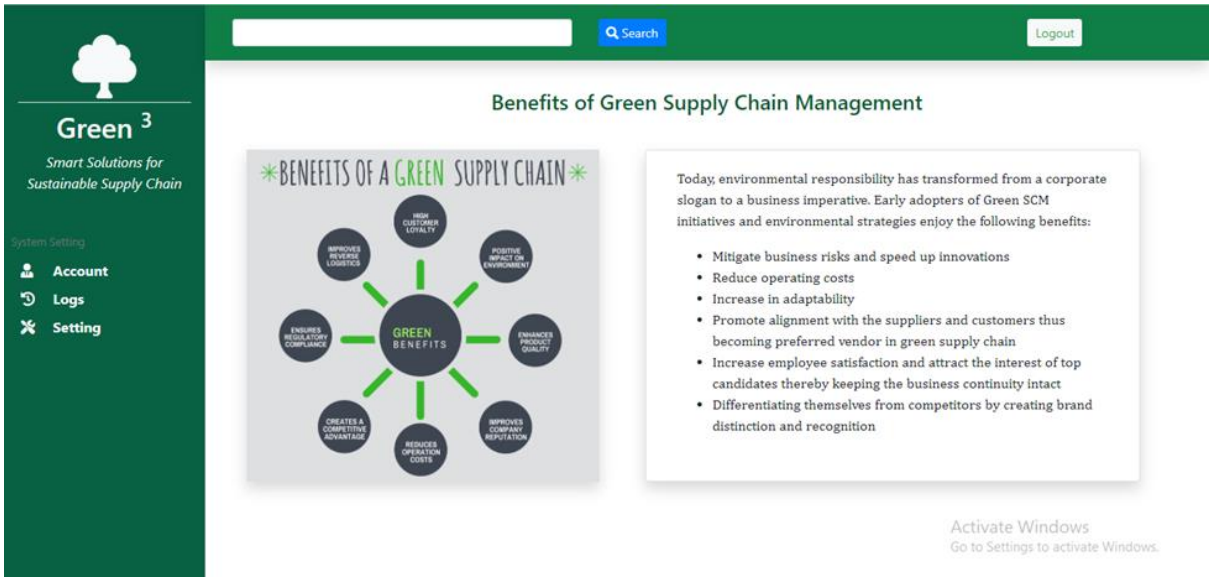

Figure 13: Benefits of Green Supply Chain Mgt. Illustrated.

Figure illustrates the benefits Green Supply Chain Management holds for an organization.

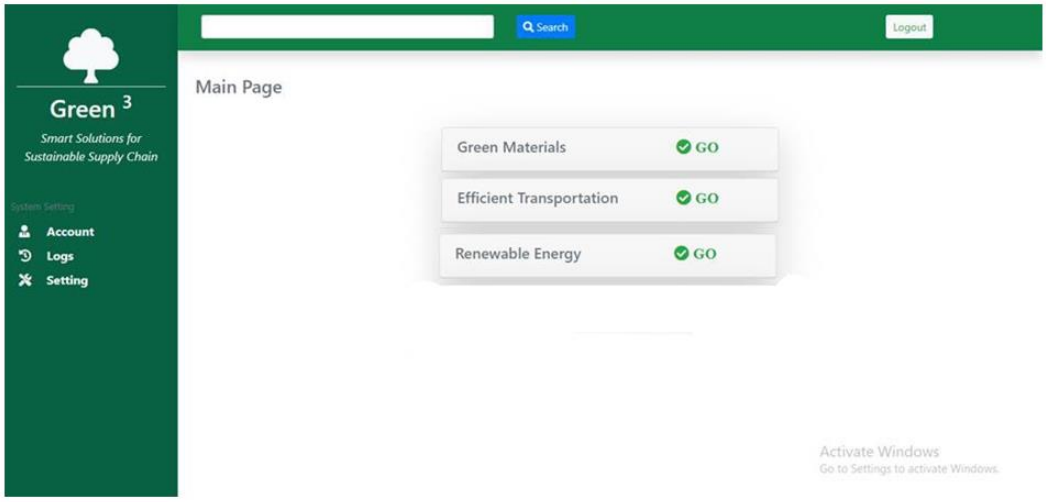

Figure 14: Main Page of the Web Portal

Figure 14 shows the Main Page of the Web Portal.

This page is further divided into four main categories:

1. Green Materials: this section will explain the available alternative green materials that can be used in construction.
2. Efficient Transportation: this section will suggest the alternatives that are available to make the transportation green
3. Renewable Energy: this section will signify the importance of using Solar Panels for the facilities and how they can reduce the carbon emissions as well as the costs incurred greatly.

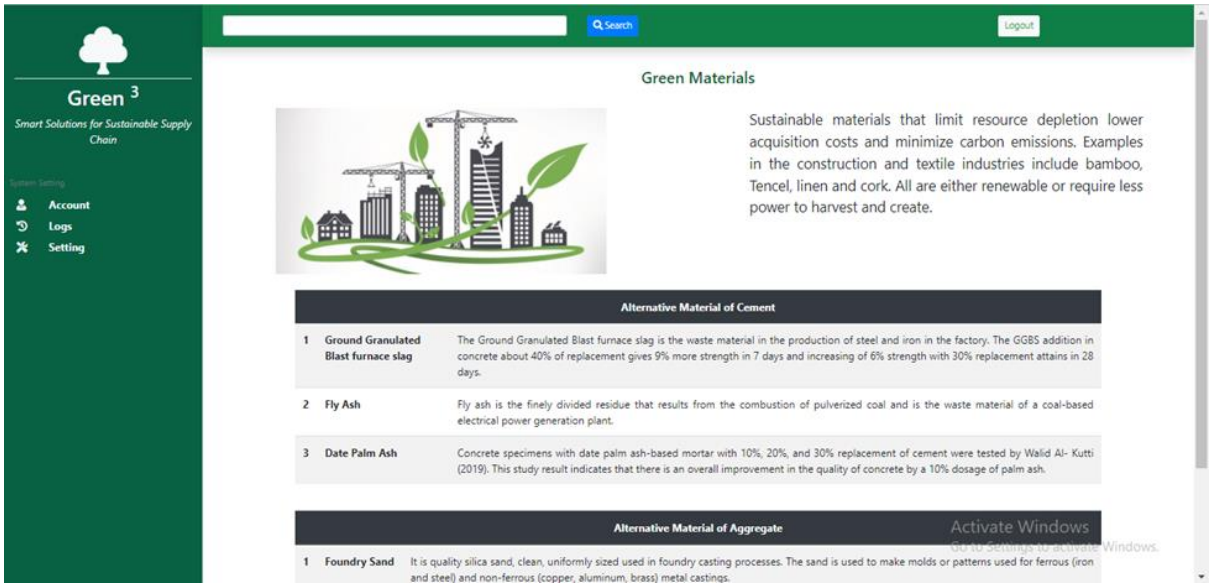

Figure 15: Alternative Green Materials explained.

Figure explains what green materials are and suggests some of the alternative green materials that can be used in the construction industry in place of the ordinary materials. Some alternatives for Cement and Aggregate are explained in the portal. Green Materials will not only help the organization to reduce their production cost, but also help in minimizing the carbon emissions. This would ultimately lead the organization towards sustainable development and green environment.

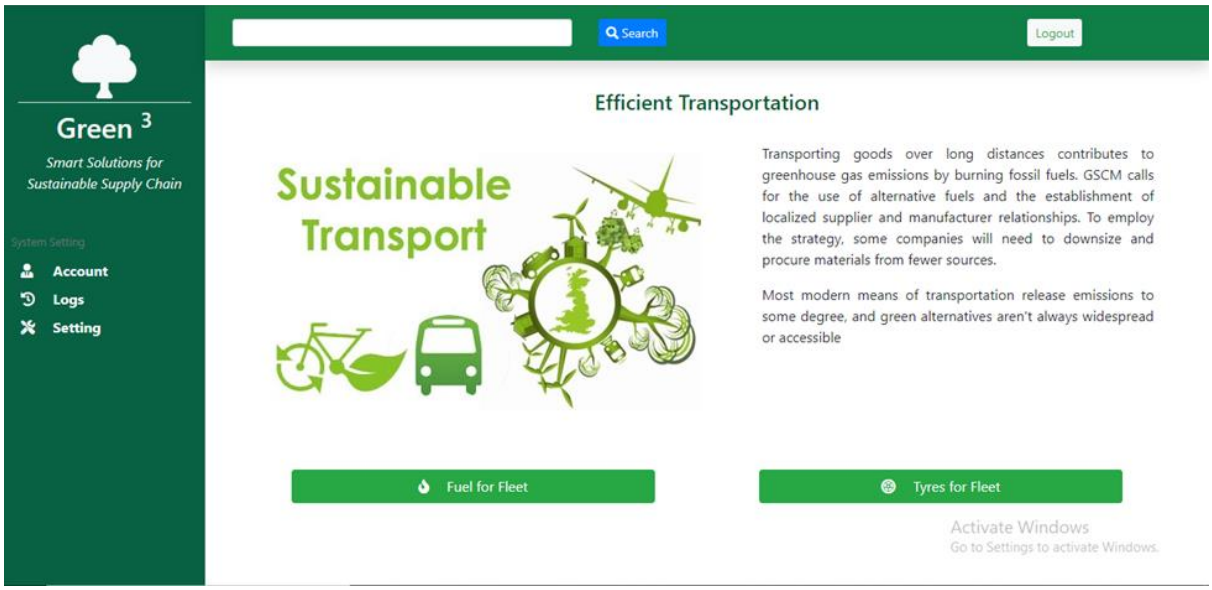

Figure 16: Efficient Transportation explained.

Figure 15 shows how the organization can lead to efficient transportation system. Transportation is one of the key drivers in supply chain management. Transportation acts as the backbone of the supply chain and alternative means in transportation (that would lead towards efficiency) will not only help in achieving sustainability but also reduce the cost incurred on transportation and reduce the enormous amounts of emissions from different vehicles utilized.

Mainly, we have proposed two such solutions in this regard i.e., Fuel for the Fleet and Tyres for the Fleet.

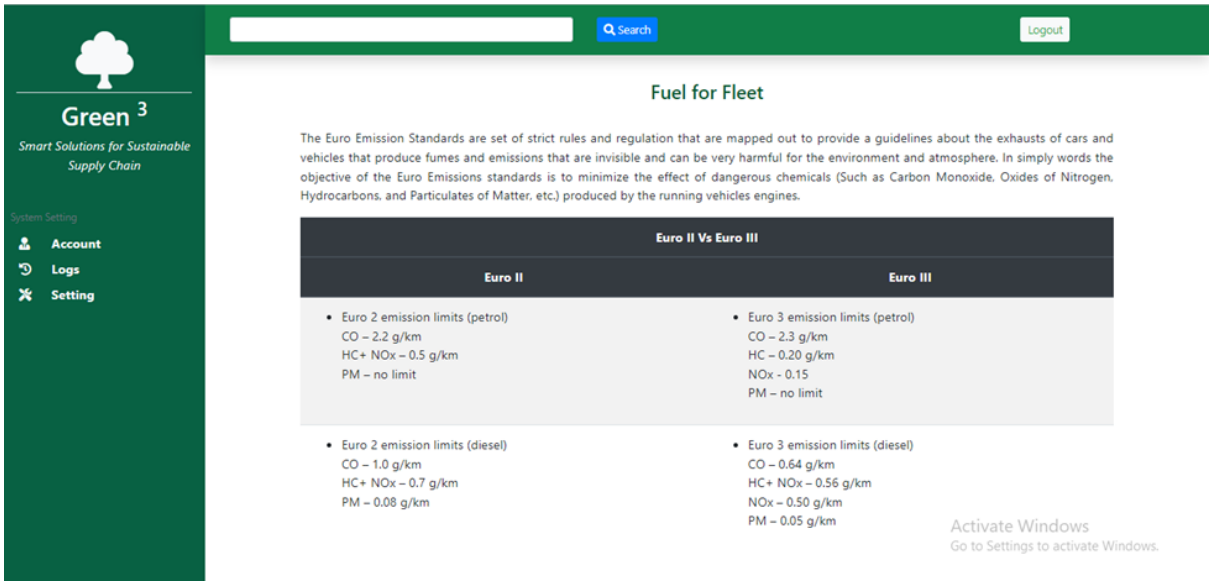

Figure 17: Efficient Fuel for fleet explained.

Figure 16 shows alternative green fuel that can be utilized by Descon for the heavy machinery and vehicles they use. A comparison of Euro II and III given above shows how the utilization of Euro III can reduce the carbon emissions of the vehicles, thereby, leading to efficient transportation.

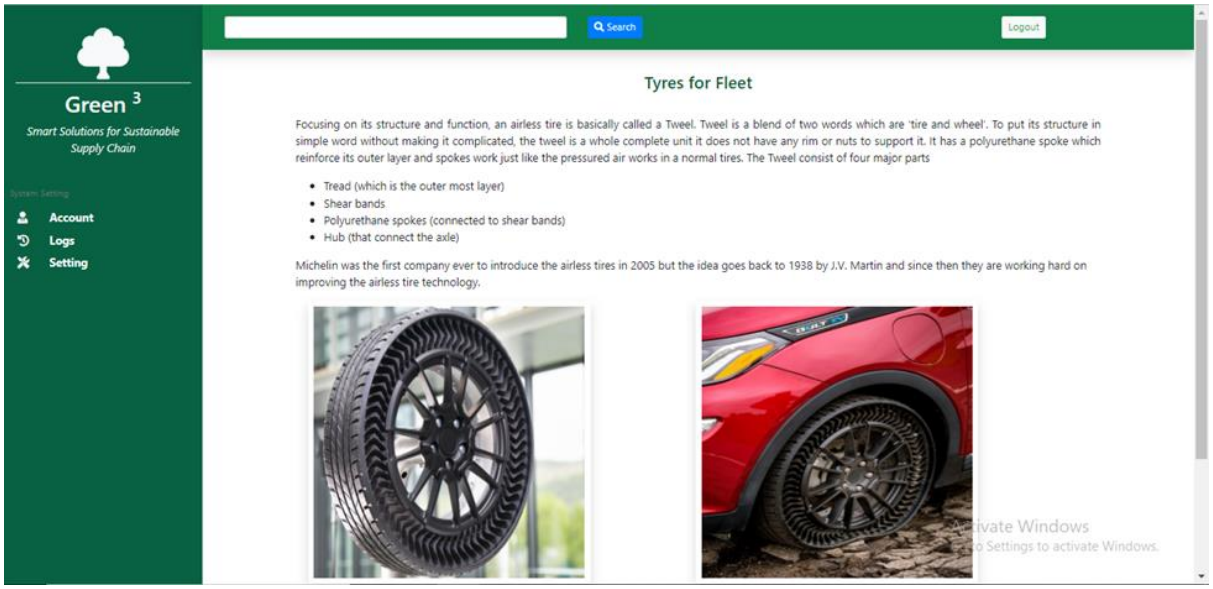

Figure 18: Environmentally Friendly Airless Tyres explained.

Figure 17 suggests the alternative of pneumatic (ordinary) Tyres used in the heavy machinery and vehicles by the organizations in the construction Industry. Airless Tyres not only have an increased average life but also saves on the maintenance cost, and therefore, are one of the means towards efficient transportation.

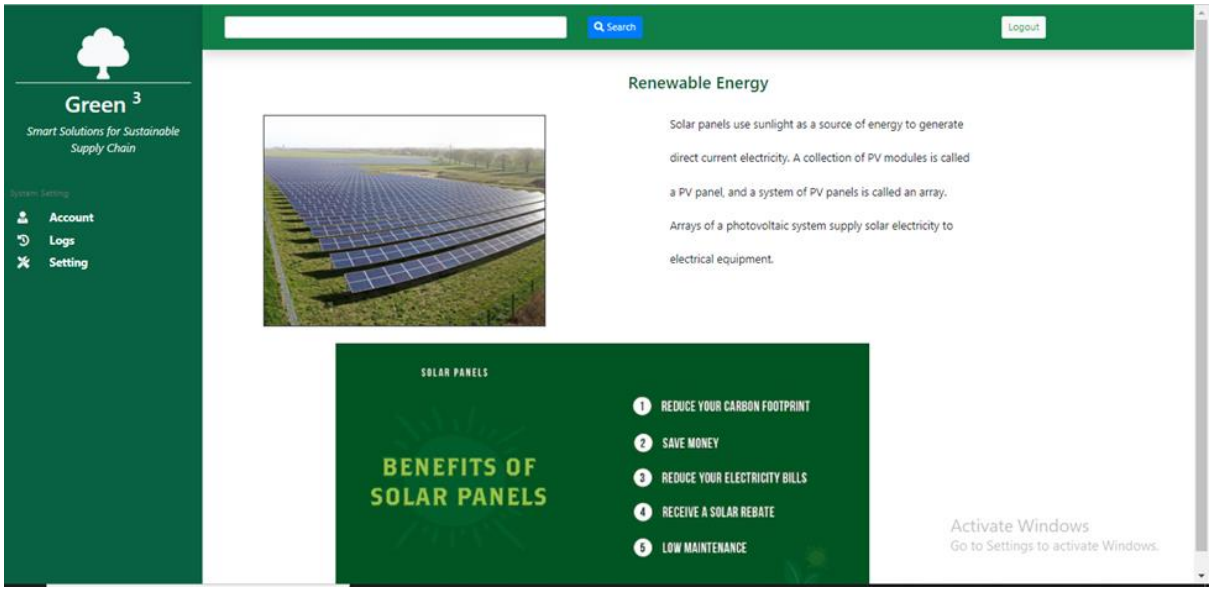

Figure 19: Importance and Benefits of Solar Panels explained.

Figure 19 shows one the renewable energy alternatives that would help the organization to not only lower their costs, but also the carbon emissions produced by them. Solar Panels are one

of the best alternatives for hydroelectricity, as it is only a one-time cost that would yield free electricity for the long run.

4.2 Implementation of the Web Portal:

In order to check whether our Web Portal would be feasible for the construction industry, we conducted a survey in which different question were asked related to green supply chain management and sustainability. All the responses had shown the importance of implementing green practices into construction industry. Moreover, the responses also confirmed the need of a web portal providing training as well as green solutions with reference to the practices taking place in the construction industry.

4.2.1 Research Design and Methodology

Feasibility study is based on a comprehensive in-depth analysis of the web portal as the purpose of the study was to determine whether our idea of providing a web portal with training and green solutions will be practically applicable and profitable or not. We intended to collect data which provided us details about the needs of the target market and their acceptance to our idea. We conducted this study in a natural environment.

While conducting this study, we faced time constraint, limited resources and finances. We conducted a survey to know about the potential market for our proposed web portal and its future demand.

i. **Analysis Unit**

   Individuals were surveyed for this analysis. The purpose behind this is that our survey was based on finding out the demand and need of the construction sector. We selected individuals from this sector as our respondents as we have designed our web portal specifically for them (for the construction of da to be more specific).

ii. **Methodology**

   The survey response was collected by individuals working in this sector to know the demand of our web portal. The main aim of this survey was to assess the views of the individual regarding our web portal and which factors were to impact its working. We assessed whether there is a need for our web portal in this sector or not.

iii. Data Type

We used Quantitative method to collect the results of the study because it was the most operative method that can be used in this limited time span.

iv. Research type

The research is cross-sectional in nature because it was conducted at one precise time.

v. Sample Size

No. of respondents (sample size) = 100

vi. Sampling Technique

Convenience sampling is the sampling technique used for data collection in this survey. It is a non-probabilistic sampling technique. Keeping in consideration all the constraints that we faced, this sampling technique was best suited. As our access to this sector was limited, we randomly surveyed people who were accessible to us.

vii. Responses

Given below is a graphical representation of response given by participants on the questions asked:

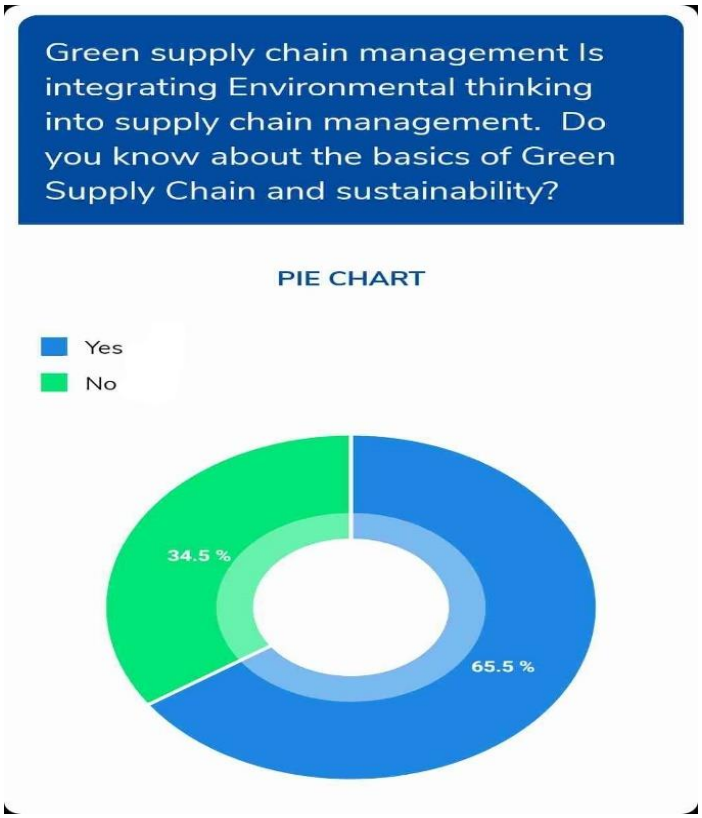

Figure 20: Response to Question No. 1 of Survey.

The response to this question shows with advancement in the technology, people are also getting aware of green supply chain which is a positive sign. Although there are many people with the basic knowledge of Green Supply Chain Management, yet the percentage of people who do not possess any skills in this field should be taken into consideration and therefore, training should be provided to them.

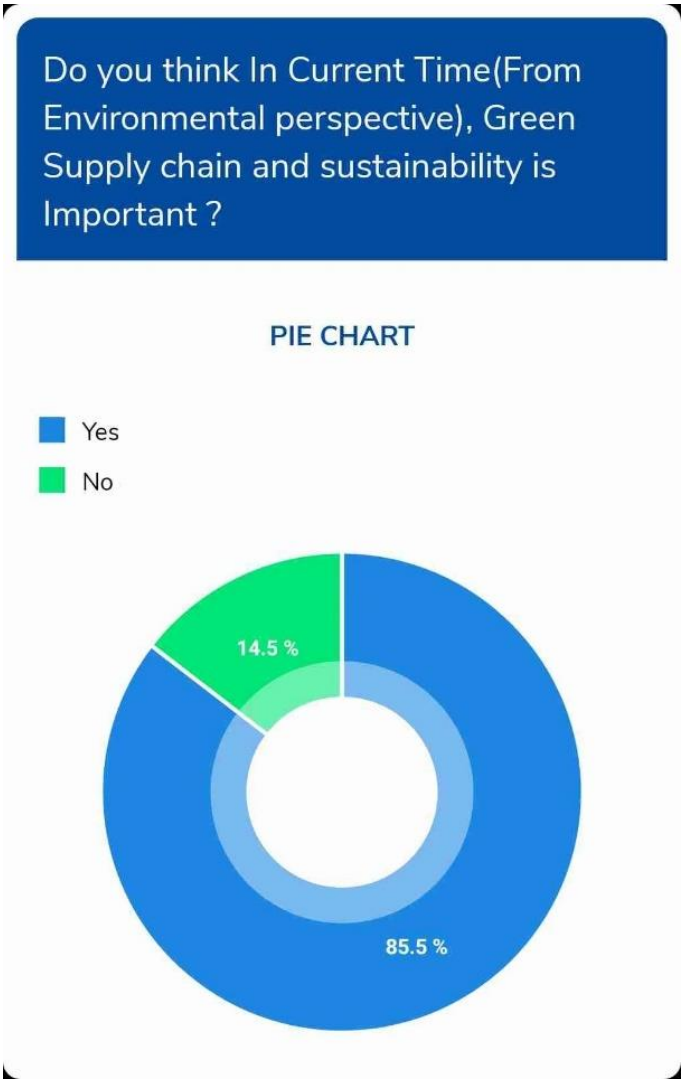

Figure 21: Response to Question No.2 of Survey.

The response to this question shows that supply chain management and sustainability is considered important in the current times. Therefore, it can be said that the people are now well-aware of these concepts and our proposed web portal will be beneficial in the coming times.

Figure 22: Response to Question No.3 of Survey.

Responses show that although people have the knowledge about green supply chain and sustainability, yet majority of the organizations are still not implementing green supply chain practices which justifies the problem definition of our project.

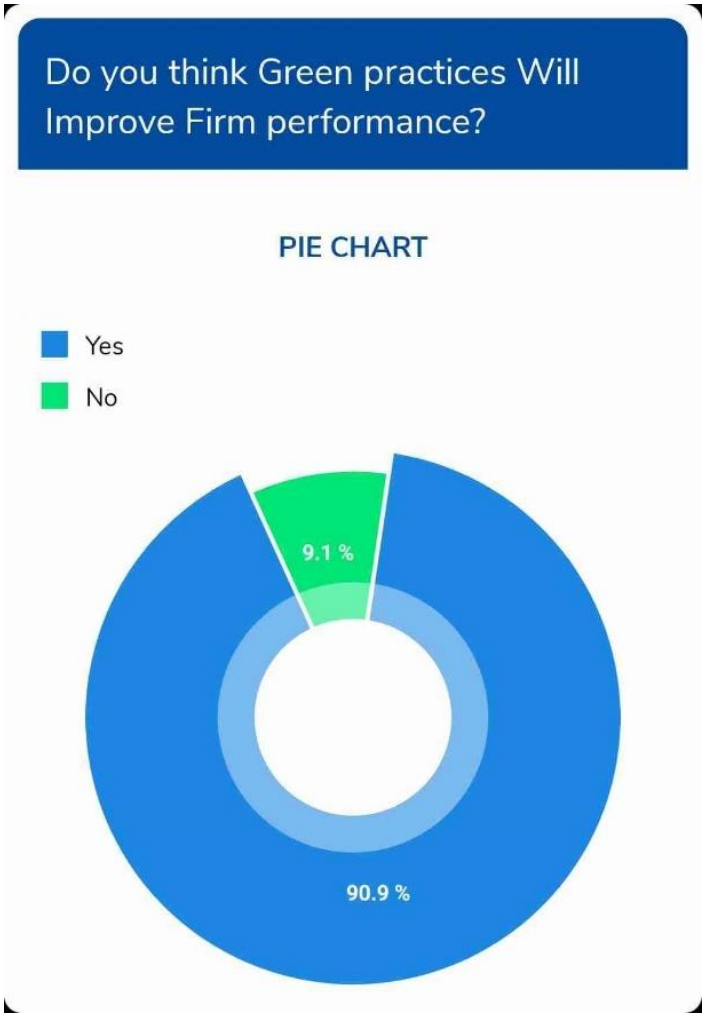

Figure 23: Response to Question No.4 of Survey.

Although any new concept can be challenging for any organization, as majority are not open to adapt new ideas. But this response shows that if organizations implement the green supply chain practices, the overall performance of the organization will be improved.

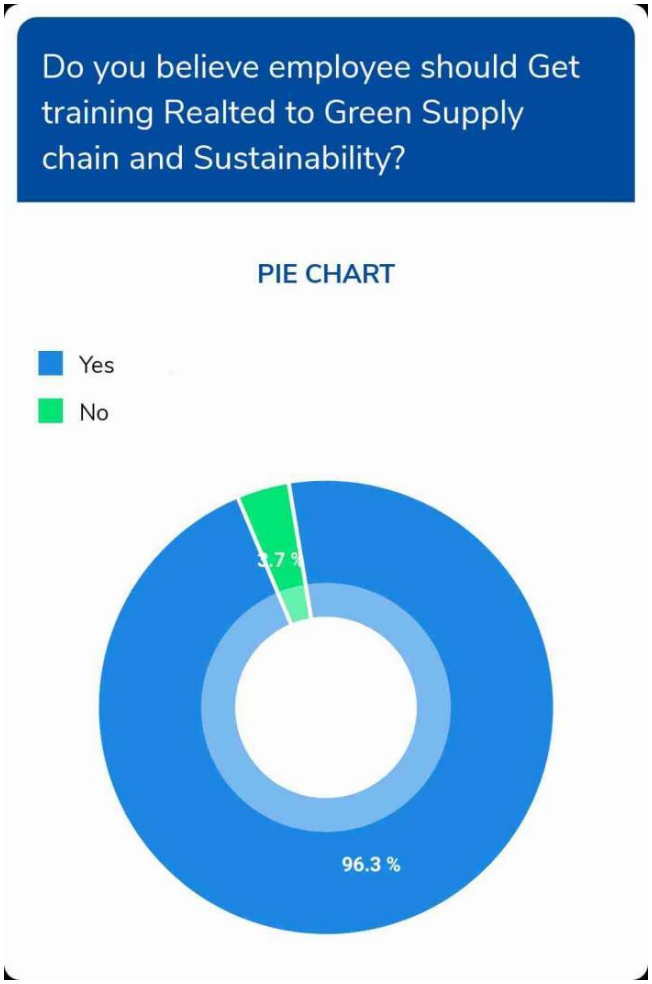

Figure 24: Response to Question No.5 of Survey.

Training and Development is one of the most important aspects in improving the performance of any organization. This response conforms with the above statement and shows that training should be provided to employees in any organization to improve their performance. This also shows the importance Beginner part in our Web Portal as it would serve as an initial training for employees to learn the basics of the Green Supply Chain Management.

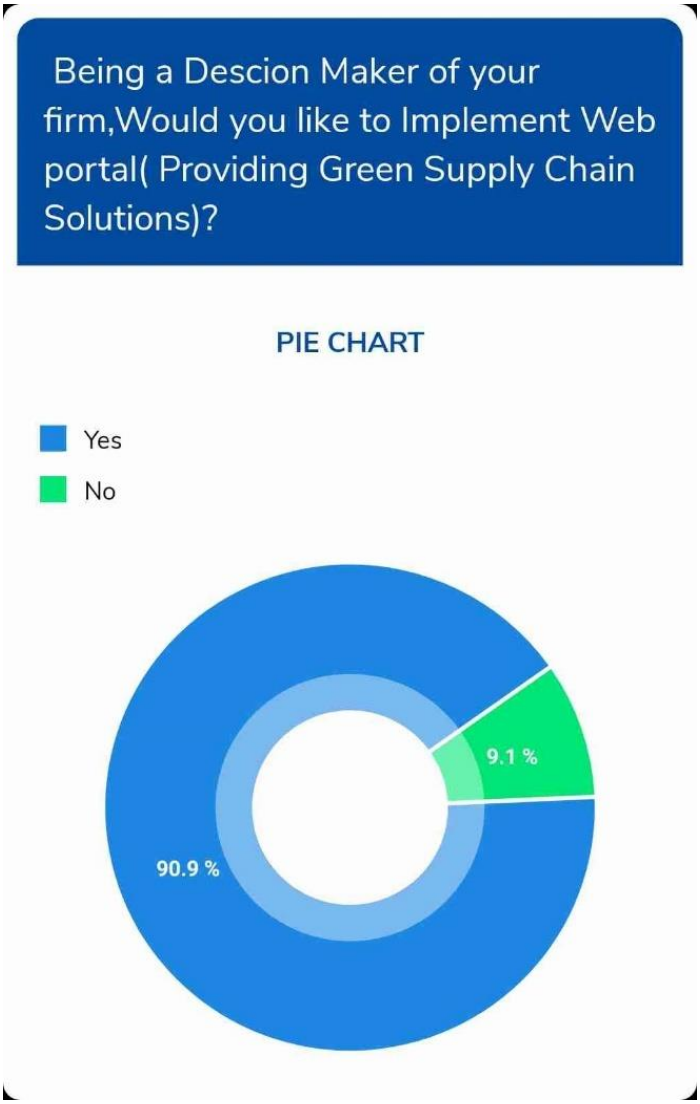

Figure 25: Response to Question No.6 of Survey.

Majority of the respondents have stated that if they have the authority of decision making, they would like to implement a web portal that would provide the solutions for green supply chain and thereby, help in achieving sustainability.

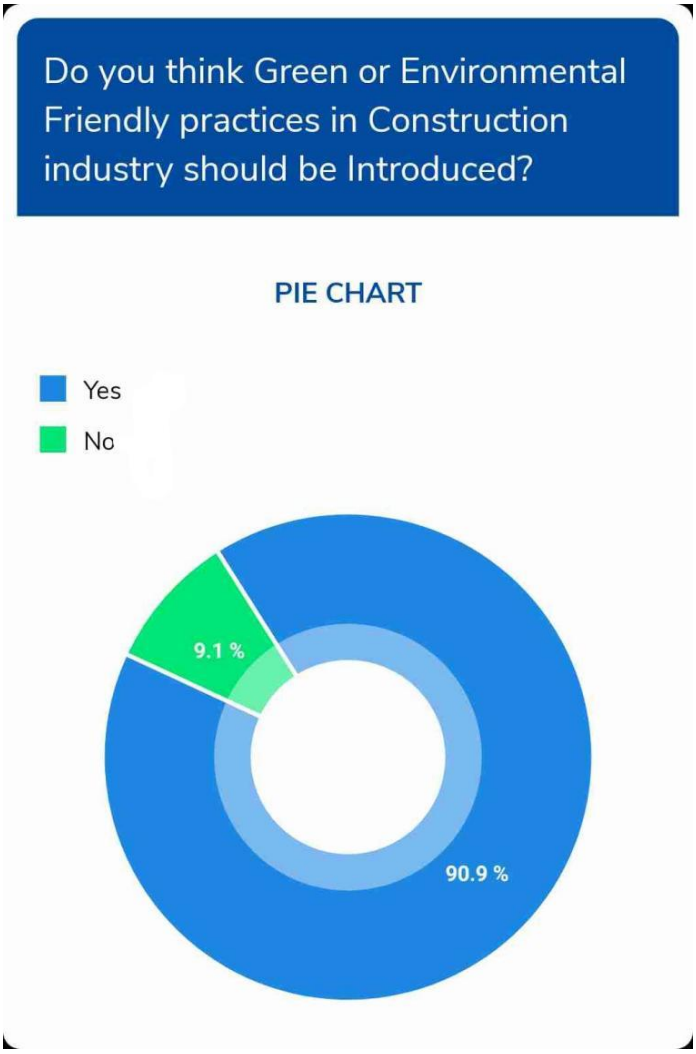

Figure 26: Response to Question No.7 of Survey.

As already mentioned, construction industry is lagging in the field of green supply chain management. The response to this question shows that as time evolves, green practices are being implemented almost in every sector. Although, construction industry is also working on it to some extent, yet more green practices need to be introduced to ensure sustainable development and growth.

As already been identified in this report, that Green Supply Chain Management and Sustainability play a very important role in any industrial sector. Due to globalization and Regulations by the government, nowadays, people are getting well-aware of these concepts. Although, Pakistan is still lagging in this area in the construction industry yet introducing environmentally friendly green practices have now been taken into consideration.

After conducting the survey, it can be concluded from the results that people in the construction industry now know the importance of Green Supply Chain and how important it is to implement green practices in their firm and industry to achieve sustainability.

This proposal has been made for Descon company, which is basically a Web Portal that contains all the green solutions required in order to improve their supply chain (either partially or completely) by implementing these. In an interview with the Manager Cost Control of the company, Mr. Ehsan ul Haq, he said that such proposals are presented to the Construction Contractor at the feasibility stage so that they can be implemented. Now, that Mohmand Dam is under construction, this proposal would be presented to the top tier of the company. This report would contain all the required information for the proposal to be accepted i.e., the proposal, observations, recommendations, and the impact analysis of the solutions provided. Now it is solely on the discretion of the end user whether they want to opt for this proposal or not. The organization will run their own cost and benefit analysis for the proposal checking whether the proposed web portal would be economical for them, as compared to the benefits provided by it. Based on this analysis, the top tier of the organization will enforce the Web Portal among all the departments of the organization. There, however, also lies a case when the organization might reject the proposal. Even in that case, the research does not goes wasted. This proposal can then be presented to other organizations in the construction sector, as it is not specifically designed for any organization, and will be equally beneficial for all organization in the sector and other sectors as well.

5 Testing and Deployment:

5.1 Testing of the Green^3 Web Portal:

Following are the results of the testing performed for the Web Portal in order to check if the overall web portal works as required or not. The table illustrates the test case for the Web Portal.

Test Case ID	Action	Input	Expected Output	Actual Output	Status
T01	Login	Valid username and password entered.	Login to Welcome Page of Green^3.	Logged in to Welcome Page	Pass
		Invalid username and password entered.	Prompt message invalid credentials and redirect to the same page.	Message prompted "Invalid Credentials" and redirected to the same page.	Pass
T02	Beginner	Clicked on Beginner	Go to Beginner Page.	Beginner Page loaded.	Pass
T03	User Manual	Clicked on User Manual to Web Portal.	Show User Manual.	User Manual Displayed	Pass
T04	Go to Main Page	Clicked on Go to Main Page	Go to Main Page	Main Page displayed	Pass
T05	Basics of Green Supply Chain	Clicked on Basics of Green Supply Chain	Go to Green Supply Chain Management page.	Green Supply Chain Management page loaded.	Pass
T06	What is Green Supply Chain Management?	Clicked on What is Green Supply Chain Management.	Go to What is Green Supply Chain	What is Green Supply Chain Management page displayed.	Pass

			Management page.		
T07	Why is Green Supply Chain Management Important?	Clicked on Why is Green Supply Chain Management important	Go to Why is Green Supply Chain Management important page.	Why is Green Supply Chain Management important page displayed?	Pass
T08	Benefits of Green Supply Chain Management	Clicked on Benefits of Green Supply Chain Management	Go to Benefits of Green Supply Chain Management page.	Benefits of Green Supply Chain Management page displayed	Pass
T09	Advanced	Clicked on Advanced	Go to Advanced (Main Page).	Advanced (Main Page) displayed	Pass
T10	Green Materials	Clicked on Green Materials	Go to Green Materials page.	Green Materials page displayed	Pass
T11	Efficient Transportation	Clicked on Efficient Transportation	Go to Efficient Transportation page.	Efficient Transportation page displayed	Pass
T12	Fuel for Fleet	Clicked on Fuel for Fleet	Go to Fuel for Fleet page.	Fuel for Fleet page displayed	Pass
T13	Tyres for Fleet	Clicked on Tyres for Fleet	Go to Tyres for Fleet page.	Tyres for Fleet page displayed	Pass
T14	Green Warehousing	Clicked on Green Warehousing	Go to Green Warehousing page.	Green Warehousing page displayed	Pass
T15	Renewable Energy	Clicked on Renewable Energy	Go to Renewable Energy page.	Renewable Energy page displayed	Pass
T16	Reverse Logistics	Clicked on Reverse Logistics	Go to Reverse Logistics page.	Reverse Logistics page displayed	Pass

T17	Accounts	Clicked on Accounts	Display editable account details	Editable account details displayed.	Pass
T18	Logs	Clicked on Logs	Display Login history details with last access to site.	Login history displayed with last access to site.	Pass
T19	Settings	Clicked on Settings	Display Settings	Settings displayed	Pass
T20	Logout	Clicked on Logout	Redirect to Login Page.	Redirected to Login Page	Pass

5.2 Deployment:

After the testing phase has been successfully completed, and all the requirements of the organization have been satisfied, the Web portal will then be sent to the deployment phase. In this phase, the whole web portal will be pushed on to the production server, so it will be accessible to the client on his browser (i.e., now Descon can use the web portal on their server and make changes accordingly). Now it will completely depend on Descon, with which departments they want to share the access of this portal and who can view this website. Also, it would depend on them regarding how to make changes in the portal so that it fits with the design of their website and is accessible to all.

6 Cost-Benefit Analysis:

In this report we have discussed plenty of ways about how we can make our environment and surroundings less harmful, have clean air to breath and improve our ways of living by focusing on sustaining greener environment. Two such elements that can help us in achieving our objective or goal is transportation and installation of solar panel. Construction sites consist of all sorts of terrains such as rocky, muddy, steep inclines and declines. Such conditions demand heavy machinery, big dumper/trucks and pickup trucks to perform the construction process smoothly. Based on our analysis and observation we have come to the conclusion that it is not possible to convert these heavy machinery and vehicles into electric or hybrid vehicles because we need to keep few things in our mind. Firstly, these vehicles work almost 10 to 15 hours a day, and all the vehicles used on site have big powerful engines (diesel engines) because of the difficult terrain and the tons of load they have to carry. Now if we turn our attention towards hybrid and electric engine there should be no uncertainty that these engines are the best thing when we talk about saving and improving the environment, but the negative thing is that they lack in power, have high maintenance cost plus electric engine demand more charging when doing heavy loading work which can cause serious halts and slows down the work progress. This does not work good for the companies' reputation where you must meet the deadlines set by the governments and other high official authorities as in the case of Descon. Furthermore, if we consider the process of hydroelectricity generation of Descon, and the generators they use to provide this electricity, all emits enormous amounts of pollutants in the environment. Also, it is a very costly process as only a 500 kW is required 24/7 throughout the week to provide electricity only for the facility. This electricity needs to be provided uninterruptedly, as any interruptions in its supply can result in data loss or other serious problems for the company. Therefore, a tradeoff is required in where we can have a significant change in the company's transportation and electricity supply system so it can be more sustainable, greener, and less harmful towards the environment as well as it should be more practical, less costly, and easily adaptable for the company.

Three of our proposed solutions should be considered here:

- Shifting Fuel from Euro 2 to Euro 3 Diesel
- Airless Tyres
- Installation of Solar Panel

6.1 Shifting Fuel from Euro 2 to Euro 3 Diesel

The Euro Emission Standards are set of strict rules and regulation that are mapped out to provide a guideline about the exhausts of cars and vehicles that produce fumes and emissions that are invisible and can be very harmful for the environment and atmosphere. In simply words the objective of the Euro Emissions standards is to minimize the effect of dangerous chemicals (Such as Carbon Monoxide, Oxides of Nitrogen, Hydrocarbons, and Particulates of Matter, etc.) produced by the running vehicles engines.

But sadly, in Pakistan due to no strict rules and implementation from the government and other higher authorities we are still using euro 2 when euro 3 is now available in some parts of the country. We suggest that DESCON should convert its fuel type form euro 2 to euro 3 for the sustainable green environment. Although the Price of Euro 3 is a bit higher than that of Euro 2, but its environmental impact is less than that of Euro 2. Moreover, it will also reduce the maintenance cost for the machinery and vehicles used by Descon (as it has lesser dangerous chemicals involved).

The difference in emissions from Euro 2 and 3 are given below

Euro II	Euro III
• Euro 2 emission limits (petrol) CO – 2.2 g/km HC+ NOx – 0.5 g/km PM – no limit • Euro 2 emission limits (diesel) CO – 1.0 g/km HC+ NOx – 0.7 g/km PM – 0.08 g/km	• Euro 3 emission limits (petrol) CO – 2.3 g/km HC – 0.20 g/km NOx - 0.15 PM – no limit • Euro 3 emission limits (diesel) CO – 0.64 g/km HC+ NOx – 0.56 g/km NOx – 0.50 g/km PM – 0.05 g/km

6.2 Airless Tyres

A normal tire is a pneumatic which means that it is controlled or operated by the air or gas under pressure the inner layer of the tire is soft and filled with the pressurized air and the outer

layer is hard that gives a cushioning feel for comfort, but it is hardened for protection against rough terrains. The issue with normal Tyres is that they get torn down, punctured easily, they are not bullet proof and air pressure effects the vehicle performance massively. Although these Tyres have negative aspects in daily use but their impact on environment is severe which needs to be considered:

- Massive consumption of Natural Resources
- Air, water, and land pollution
- Landfill upkeep
- Insect incursion/infestation
- Fire Hazard

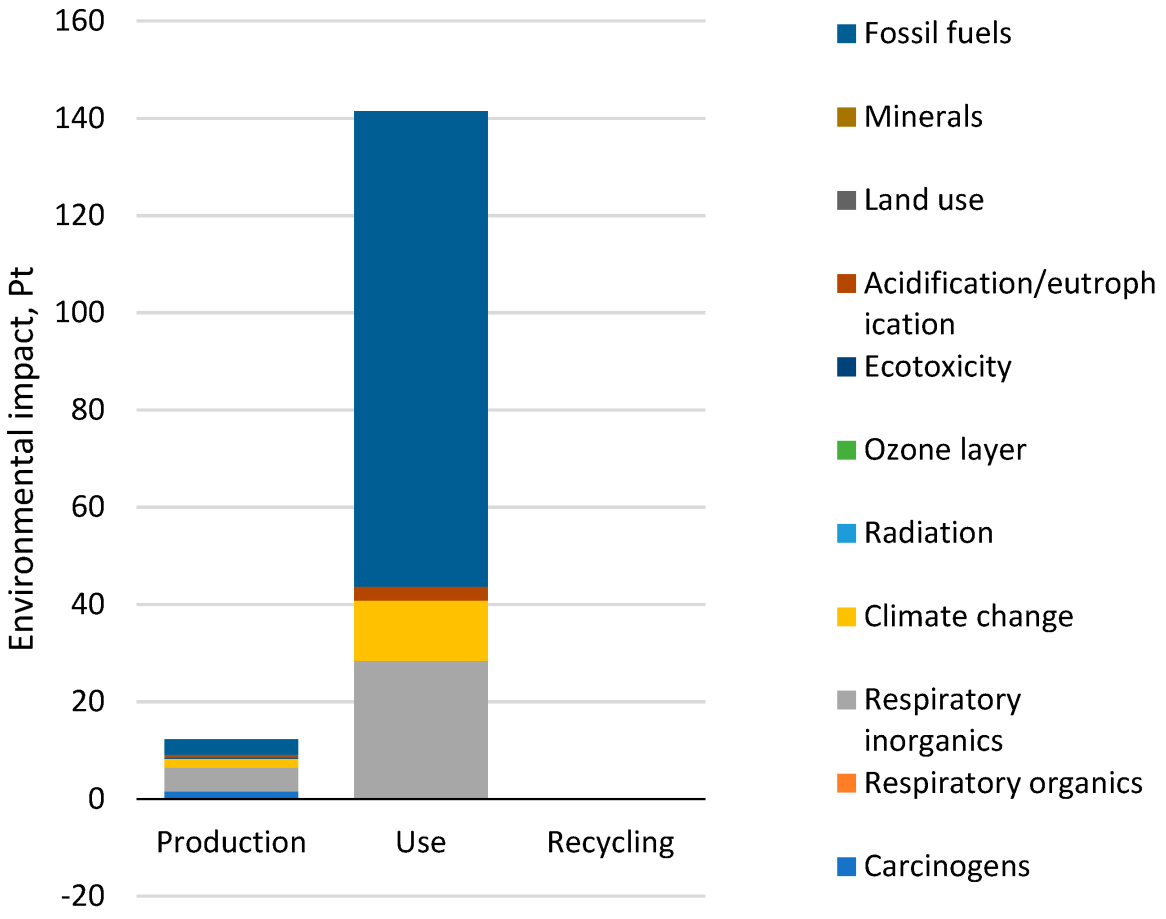

Figure 27: Impact of Pneumatic Tyres on Environment.

Compared to pneumatic Tyres, Airless Tyres are far better and much more suitable for green environment. But like every other thing airless Tyres also have their pros and cons because

these Tyres right now are in the process of research and development. With time and more exploration, this technology will get better and surely surpass its predecessors.

Focusing on its structure and function, an airless tire is basically called a Tweel. Tweel is a blend of two words which are ‘tire and wheel’. To put its structure in simple word without making it complicated, the tweel is a whole complete unit it does not have any rim or nuts to support it. It has a polyurethane spoke which reinforce its outer layer and spokes work just like the pressured air works in a normal Tyres. The Tweel consist of four major parts

- Tread (which is the outer most layer)
- Shear bands
- Polyurethane spokes (connected to shear bands)
- Hub (that connect the axle)

Michelin was the first company ever to introduce the airless Tyres in 2005 but the idea goes back to 1938 by J.V. Martin and since then they are working hard on improving the airless tire technology.

The below pictures represent the Michelins UPTIS

Figure 28: UPTIS Tyres by Michelins

The positive aspect of this technology is that it has no air, so it does not blowout, get cut or punctured, absolutely no maintenance cost. It is a kind of once installed just use and throw technology, keeps working even if it gets damaged. When compared with normal tire it has long usage life, and the best thing is it is bullet proof.

Considering these facts, we can suggest Airless Tyres for commercial use in heavy industrial vehicles as these Tyres would improve and have a positive greener impact on the environment and it will help DESCON in achieving a competitive edge in terms of green transportation. As compared to normal Tyres, airless Tyres are better because

- It has a unique design
- it consumes less resources
- it can be reused into entirely different products
- it is 3 to 4 times more durable and has long lifetime than a normal tire
- they consume less rolling power which eventually leads to less fuel consumption

Specifically talking about DESCON, where terrain is all time rough and rigid, airless Tyres specially UPTIS can do wonders. it's an all-terrain tire which has more grip and less slips than normal Tyres and once installed in the heavy industrial vehicle. Also, it will drastically lower the chance of wear and tear which keep the maintenance cost to all time low. Furthermore, due to low amount of damage it will greatly increase the working hour of every vehicle which will be installed with airless Tyres. The following calculations also speak in the favor or Airless Tyres:

Pneumatic Tyres	Airless Tyres
Cost of 01 Tire = Rs. 40,000 Average Life of a Tire (in Construction Industry) = 4000-10,000 hours Working hours per day = 8 Therefore, average life of a tire (in years) = 1.36 - 3.42 years	Cost of 01 Tire = Rs. 100,000 Average life of airless tire = 3 times more than a pneumatic tire Therefore, average life = 12,000-30,000 hours

These calculations clearly show that although the cost of an airless tire is more than that of a pneumatic tire yet, it is just a one-time cost. The average life an airless tire is three times more than that a normal tire, as well as it does not require any maintenance cost. Therefore, Airless Tyres are more beneficial in the longer run.

6.3 Installation of Solar Panel

Solar panels are used to generate electricity using solar energy. Following are few of the benefits of using solar panels:

- Solar panels help to reduce the carbon footprints and emissions significantly.
- The installation of a 250kW (half-load of the generator required by Descon) Solar panel will reduce greenhouse gas emissions by over 9470 tons in its lifetime.
- Financially, solar panels are worthy for any organization. A 250-kW solar panel would save up to Rs. 7,700,000 per year.
- Solar panels require very little maintenance. The only additional cost incurred would be the replacement of inverters/batteries but that may occur once every 10-15 years.

Following are the calculations which shows the difference between the cost Descon is currently bearing, and the cost they will have to bear if they install solar panels:

Hydroelectricity	Solar-Electricity
Total Electricity Load for Facility: 450-500 kW Cost for shifting half load on solar system	
Generator Required of 250kW (24/7) Diesel Required = 60 liter/hr. Diesel Required for 1 day= 60 x 24 = 1440 liter Diesel Required in 1 year= 1440x 365 = 525,600 Liters Price of 1 Liter Diesel= Rs. 147 Annual Cost of Diesel = 525,600 x 147 = Rs. 77,263,200	Cost of Solar Panel of 10kW = Rs. 1,250,000 Cost of Solar Panel of 250 kW = 1250000 x 25 = Rs. 31,250,000 Total Cost (inclusive of installation and maintenance) = Rs. 40,000,000

Above calculations show that after the installation of the solar panel, the total cost incurred would be Rs. 40,000,000 for the full setup. The annual total cost incurred on the consumption of diesel by the generators is Rs. 77,263,200 (in case of Hydroelectricity). This shows that the cost incurred on the solar panel is far less the total cost incurred just on the annual diesel consumption. Although solar panels are dependent on the sunlight, therefore different weather conditions would also affect its performance, yet if we only shift half of the total load of the

facilities on solar still it can do great wonders. Therefore, it can be said that the Solar Panel option is more feasible as it is less damaging to the environment and cheap as well.

7 FUTURE ENHANCMENT

The proposed solution which is web portal has a very broad scope in future. Portal can be easily updated in the future according to the needs and requirements of the organization as it is very flexible. This portal can be used in future both publicly and commercially. The following are the future scope/action plan for the project:

7.1 Introduction of Reverse Logistics:

Reverse Logistics can be employed in order the reduce or reuse materials in the construction industry. At the Mohmand dam Construction Site, crushing is one of the activities as yields a lot of waste. This waste (which is usually Crusher run, gravels, or fine mud and sand) can be utilized in many other processes like building roads, driveways, masonry, etc.

7.2 Energy-Efficient Warehousing:

Green Warehousing will help to introduce environmentally friendly warehouses by proposing different materials and facility options that prove to be energy efficient. Normal warehousing can be replaced with energy-efficient warehousing. Different techniques regarding how to make energy-efficient warehouses and their benefits have also been stated below, that would help the organization to reduce their warehousing costs and to achieve sustainability.

Reduce Your Lighting Cost	By adopting more efficient lighting systems most warehouses can save as much as 50% on their energy bill.
Change to Fluorescent Lighting	Another feature of good lighting design is using fluorescent lighting. Many warehouses use sodium or metal halide designs, but replacing them with fluorescent can not only lead to an energy saving of up to 80% but can also result in better lighting
Install Insulation in Your Warehouse	The largest cost next to lighting for any warehouse is the money spent on managing the temperature. Roof and wall insulation is important as a first strategy for reducing energy outlays
Planting Trees	Planting trees around the perimeter of the building and making shaded areas will cut some of the external heating, allowing you to reduce your cooling bill and making your warehouse more carbon neutral.
Using Battering-powered Forklifts	Using battery-powered forklifts can reduce your carbon footprint by decreased emissions but it can also save you money on repairs. The reduced load on your exhaust fans and ventilation systems from an absence of exhaust fumes will increase the life and performance of both of these systems.

Figure 29: Different Ways to Introduce Energy-Efficient Warehousing.

7.3 Security Features:

It is very important to keep the information on the internet safe from the hackers. Keeping this in mind, In the future, many Security features such as face unlock, QR code and thumb impression can be introduced which would not only help to prevent the portal from being hacked but also ensure that no other party or an unauthorized person has access to the system.

7.4 Mobile Application Development:

As our proposed solution is just the introduction phase with limited resources, at this point we have only developed a web portal for the organization. In the future times, the Web portal can be introduced to the mobiles using the Mobile Application development. Both, the IOS and Android versions of the mobile application can be introduced for the ease of use. By doing this, it will help the employees to easily access as well as upgrade and share any kind of information or data through the mobile application.

7.5 Augmented Reality:

As in the future we have a plan to shift the portal into the app, the Feature of augmented reality can be introduced. Through this feature, the employees or management would have a better idea as it is an experience where the designers enhance parts of user's physical world with computer-generated input that will help the management to make decisions more efficiently and effectively.

7.6 Solutions according to the Requirements:

Upgrading is important in any portal or app to compete with the competitors. similarly, the web portal will be upgraded in the future in such a way that it will get the information from the employee and will provide the solution according to the problem. The feature of self-smart can be added (Web portal will suggest a solution by itself according to the problem)

7.7 Database Integration:

Currently the portal is connected to its database only but in future, it can be connected to another database, which will help the management or firm to have more access to the Information as it can be connected directly to google or other browsers.

8 Conclusion

Construction industry is one of the major sources of environmental pollution. There is no such web portal that will help the organization, that will tell them how they can change their traditional supply chain into green supply chain. People are getting more and more aware about sustainability and environmental-friendly construction. In such scenario we proposed a solution that will help the Descon in shifting the supply chain into green supply chain. we conducted a survey in which we asked different questions related to green supply chain and sustainability. The results had shown that the people are now getting aware of sustainability. The proposed web portal is smart, reliable and user friendly. We developed a solution which has all the good features that includes 1) Green materials 2) Efficient transportation 3) Energy efficient warehousing 4) Reverse logistics.

This web portal will be user friendly, and all the guides will be available for beginners. This portal will help Descon to introduce green supply chain which will not only help them to gain a competitive advantage but also in sustainable development. In future this portal will be converted into app, which will help firm in saving their time, energy, and resources by making decision more smartly by using it. In out proposed solution we suggested different solutions to Descon that will not only help them economically but socially as well. If the firm will work on sustainability and if they tackle the environmental issue this will build good image in the eyes of the public.

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