

# Sustainability

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Supervisors:

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Dr. Husam Arman

The End  
Thanks for listening



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Introduction



Literature review



Methodology



Data gathering



Data analysis



Model development



Conclusions & Recommendations

# Introduction

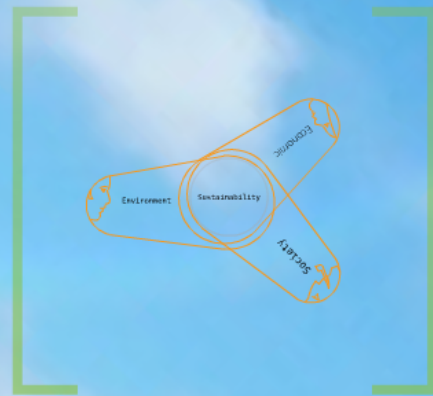
- The recent emergence of various environmental problems has been drawing the attention of the global community.
- These issues highlighted the importance of finding means of protection of our planet leading to the discovery of Sustainable Development.

# Introduction

- Nowadays, global society is facing low if not scarce water, material, and energy resources.
- This fact caused future generations to become the main concern of the modern world, driving it to create new concepts such as sustainability, which became a hot topic and a global trend.

# Introduction

In general, sustainability means the capacity to support, maintain or endure but is also defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”



## Introduction

- On a global scale, we consume roughly 10 billion tons of engineering materials per year.
- In case of Palestine, an environmental impact of 847,238 million tons of waste annually produced.



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# Introduction

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# Introduction

- All these problems are indicators of a lack of awareness in sustainability in governmental, industrial and academic institutions.

## Objectives

- 1- To assess the awareness level from governmental, industrial and academic perspective by using interviews and an online survey conducted for An-Najah National University students.
- 2- To demonstrate the impact of sustainable engineering when applied in Stone and Marble sector in the West Bank.
- 3- To propose potential solutions and initiatives that can contribute to sustainable engineering in the governmental, industrial and academic institutions.
- 4- To improve sustainability level in Stone and Marble industry through assessing the current situation and then suggesting a resource-efficient model.

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- 4- To improve sustainability level in Stone and Marble industry through assessing the current situation and then suggesting a resource-efficient model.

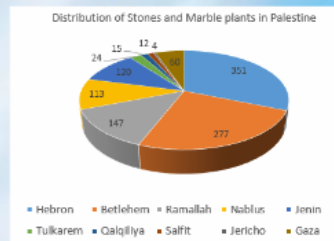
# Literature review

- Still no clear vision for regulations and sustainability standards.
- Good environmental practices increase company profits.
- Some related studies conducted by The Palestinian Central Bureau of Statistics:
  - The two most familiar ways to dispose waste in the Palestinian Territories in 2009 were throwing waste in the nearest waste container (73%) of , and the second way was burning it (21.3%) .
  - CO2 emissions for 2010 were about 1.03 tons per capita.

# Literature review

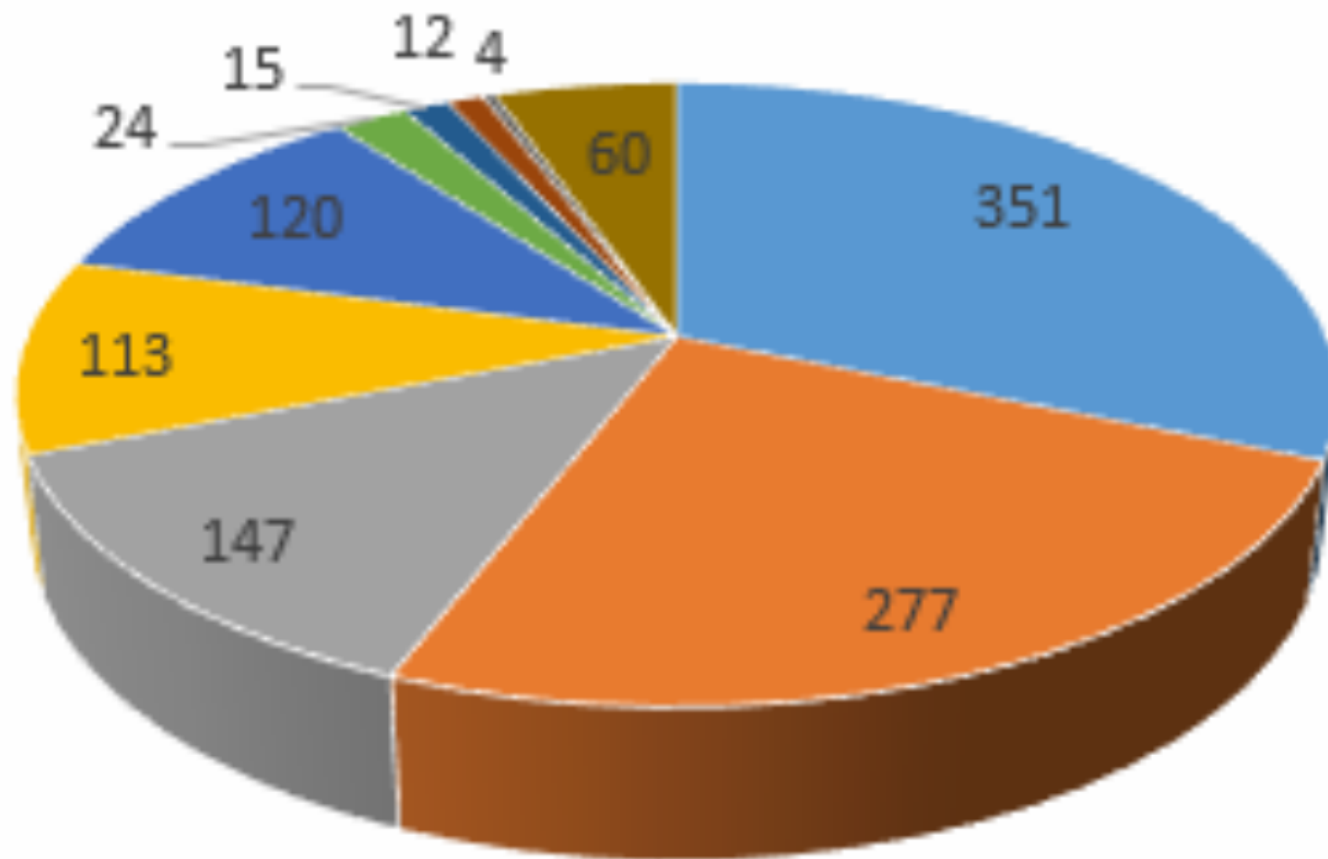
Stone and Marble Industry:

- this sector contributes approximately 25% to Palestine's overall industrial revenue.
- Palestinian stone and marble constituted approximately 4% of world production



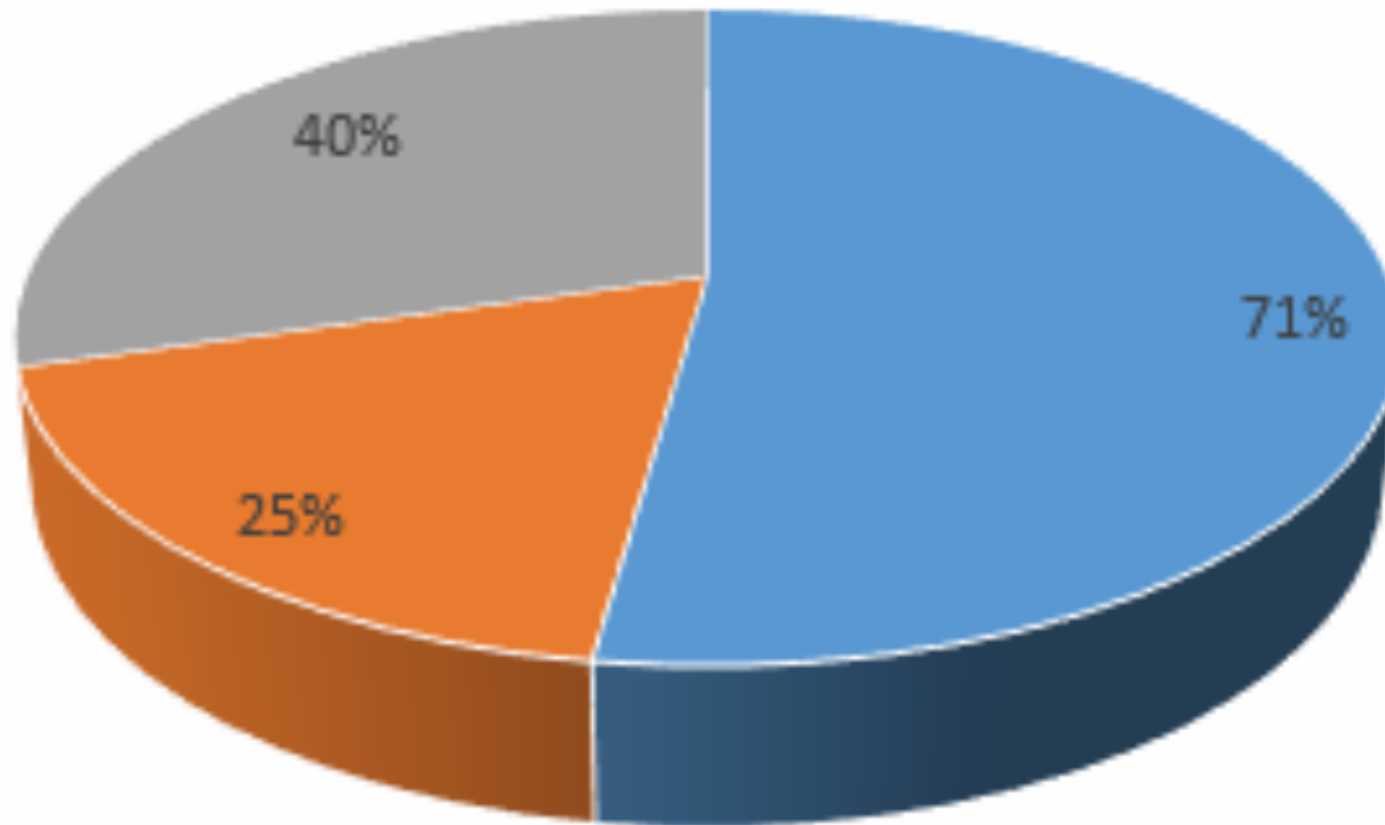
• CO2

# Distribution of Stones and Marble plants in Palestine



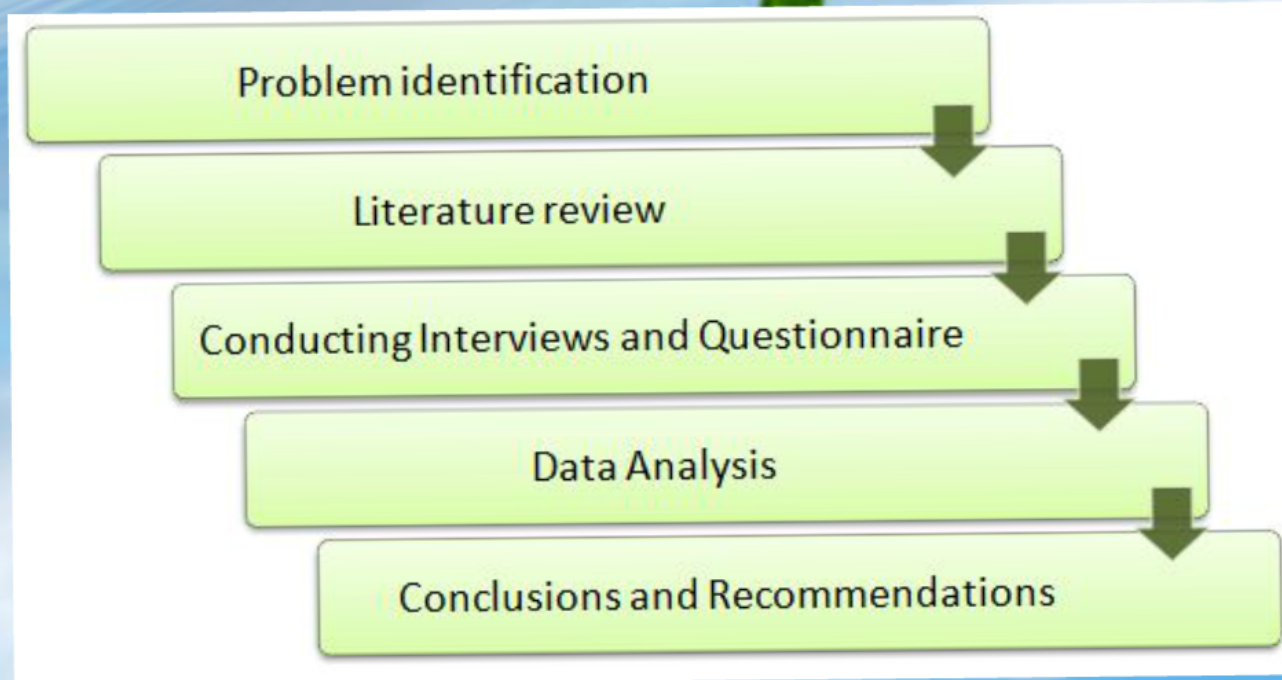
- Hebron
- Betlehem
- Ramallah
- Nablus
- Jenin
- Tulkarem
- Qalqiliya
- Salfit
- Jericho
- Gaza

# Market



■ Israeli market    ■ local market    ■ Export markets

# Methodology

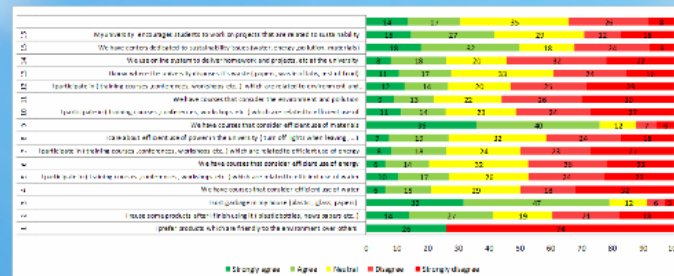
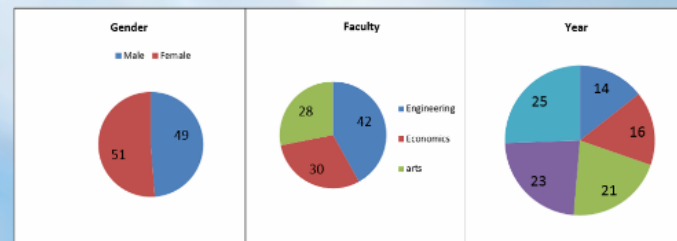


# Methodology



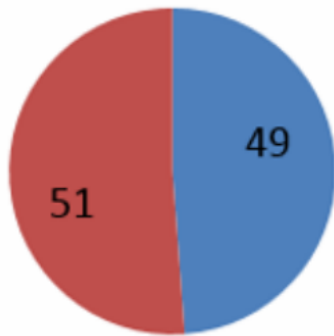
# Data Analysis

## Questionnaire



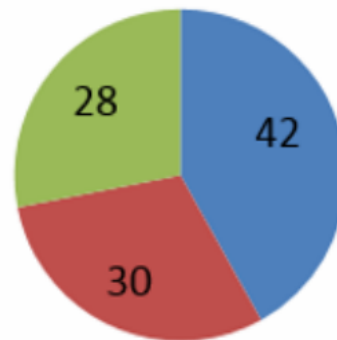
### Gender

■ Male ■ Female

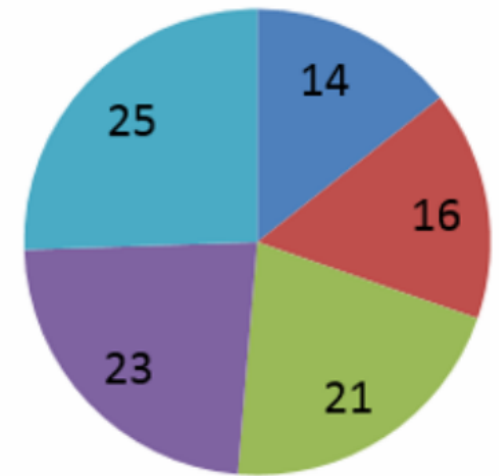


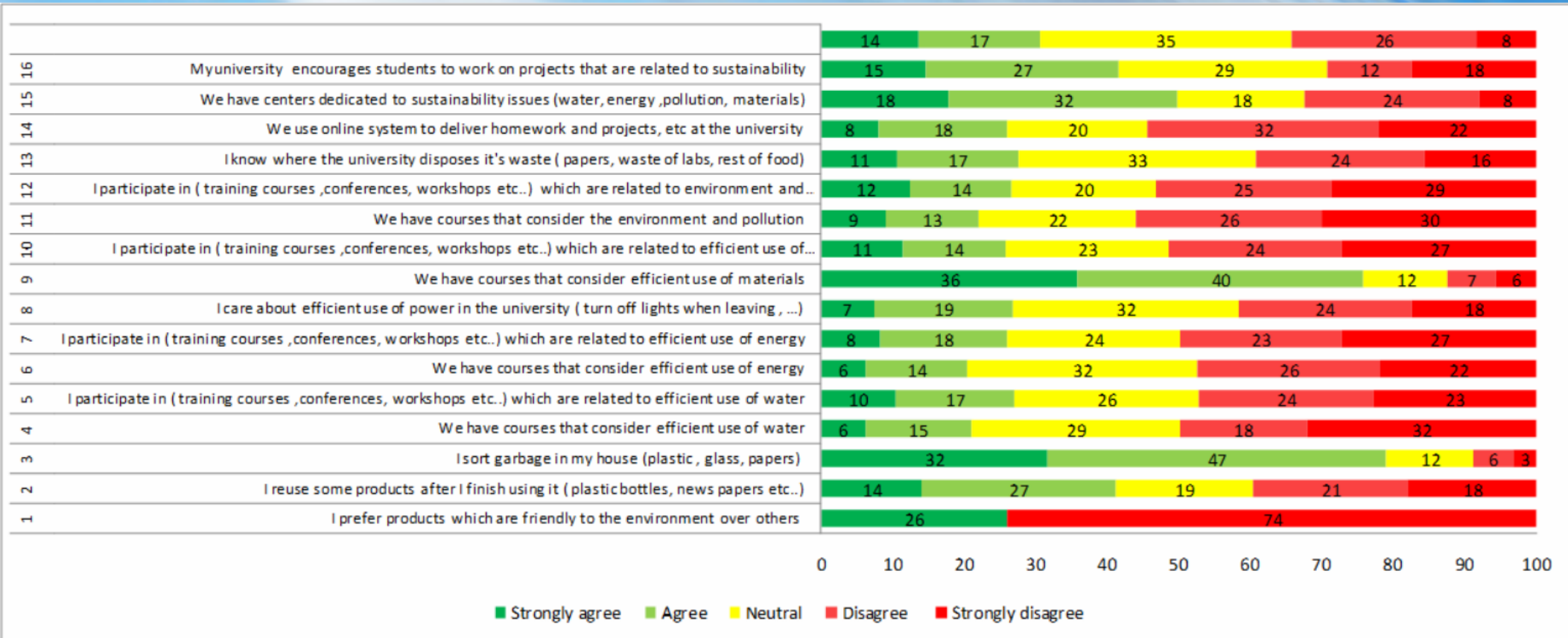
### Faculty

■ Engineering  
■ Economics  
■ arts



### Year





# Data analysis

## Interviews

- Interviews were made up of five multi-part questions that took approximately 30-40 minutes to complete.

### Government

- The general view of government was positive towards acting upon sustainability matter and they showed general awareness with this regard in terms of understanding its importance.
- It failed to initiate laws to regulate the various sustainability related activities.

### Industry

- The awareness in the industry showed varied results as some firms had already taken actions towards this issue while others seemed to be almost ignorant.
- The competent firms were only interested in the area where significant savings can be achieved in applying sustainable concepts and would reflect positive financial results.
- The lack of resources encouraged firms to look at more sustainable approaches in their processes as was the case of some manufacturing firms in the south of Palestine where water is very scarce.

### Academia

- This investigated perspective was the role of academic institution and their awareness through looking at the programs and curriculums, research programs, and various related activities such as conferences, workshops and seminars.
- The top universities in the country have already taken some initiatives in collaboration with European universities to develop academic programs in sustainability.

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# Checklist Development

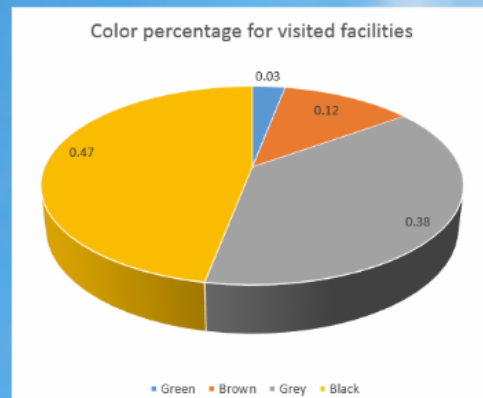
- Checklist was developed containing six main categories (Energy, Water, Waste, Safety and human health, Transportation and Site management).
- Each theme is given a weight as a percent according to its importance and its environmental impact, taking into consideration the three aspects of the sustainability which is economic, environmental and social.

# Data Collection

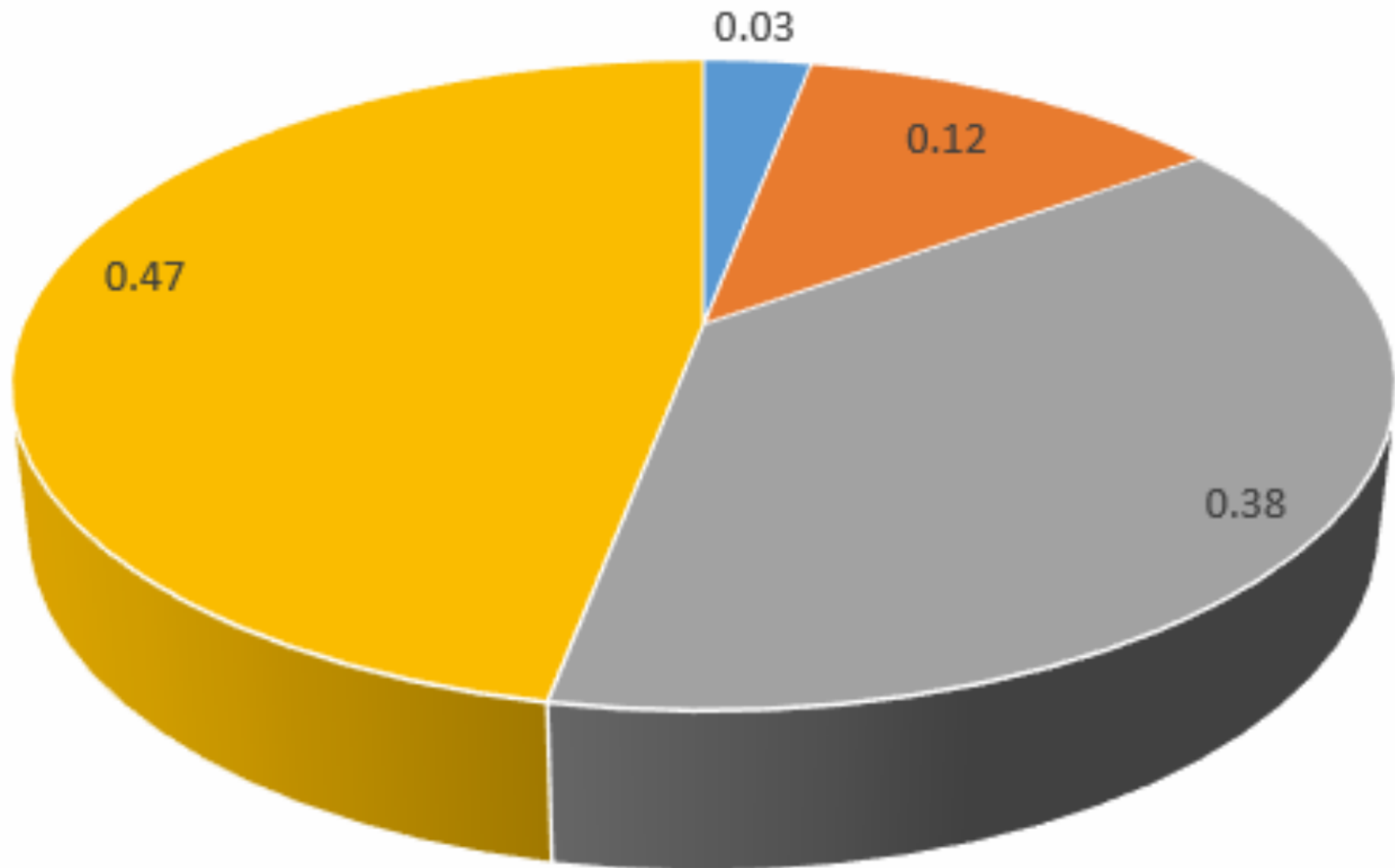
- Different Stone and Marble firms were visited to assess the level of each firm
- In each visit, a quick tour in the firm facilities was done to have a first impression of the situation.
- An interview with the person in charge of the facility or the production line was conducted to fill the checklist.
- 32 visits were conducted in the West Bank, concentrating on the most popular cities in this industry; Bethlehem, Hebron, Jenin "Qabatya", Ramallah and Nablus.

# Data analysis

- An excel sheet was developed in order to analyze data in the checklist and give a rate (points out of 5) for a certain firm.
- Each checklist was analyzed through this excel sheet in order to determine the firm color (rank).



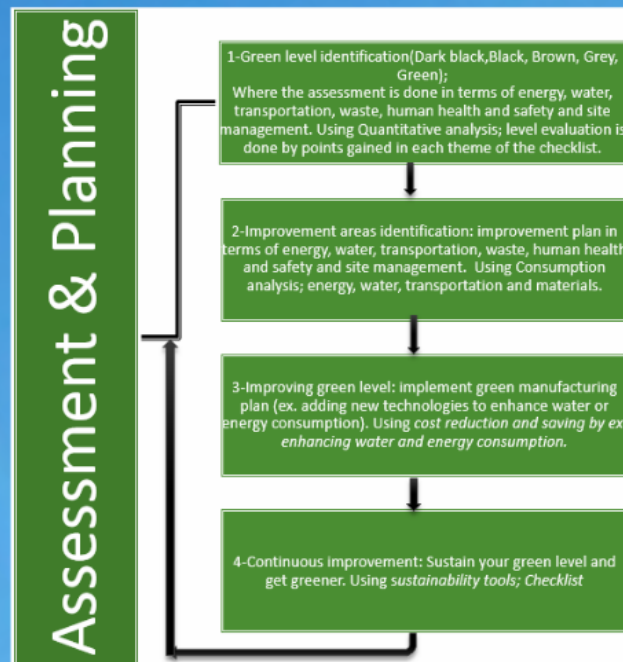
## Color percentage for visited facilities



■ Green ■ Brown ■ Grey ■ Black

# Model Development

- This model has been structured in order to assess the level of adopting sustainability concepts "green level" for stone cutting facilities and also shows how to improve the facility's level (color).



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# Assessment & Planning

1-Green level identification(Dark black,Black, Brown, Grey, Green);  
Where the assessment is done in terms of energy, water, transportation, waste, human health and safety and site management. Using Quantitative analysis; level evaluation is done by points gained in each theme of the checklist.

2-Improvement areas identification: improvement plan in terms of energy, water, transportation, waste, human health and safety and site management. Using Consumption analysis; energy, water, transportation and materials.

3-Improving green level: implement green manufacturing plan (ex. adding new technologies to enhance water or energy consumption). Using *cost reduction and saving by ex. enhancing water and energy consumption.*

4-Continuous improvement: Sustain your green level and get greener. Using *sustainability tools; Checklist*

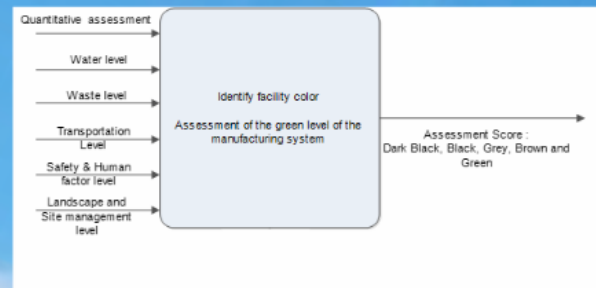
# Model Development

## 1. Identifying the current level "color":

- The objective of this stage is to identify how "green" the facility is or what is the current color level of adopting sustainability concepts.
- The checklist is divided into six main categories (Energy, Water, waste, Safety and human health, Transportation, and Site management), where each category has one or more prerequisites that are required as the minimum performance.
- Each category has optional points that can be achieved in order to be classified into the advanced levels which are (Gray, Brown and Green).

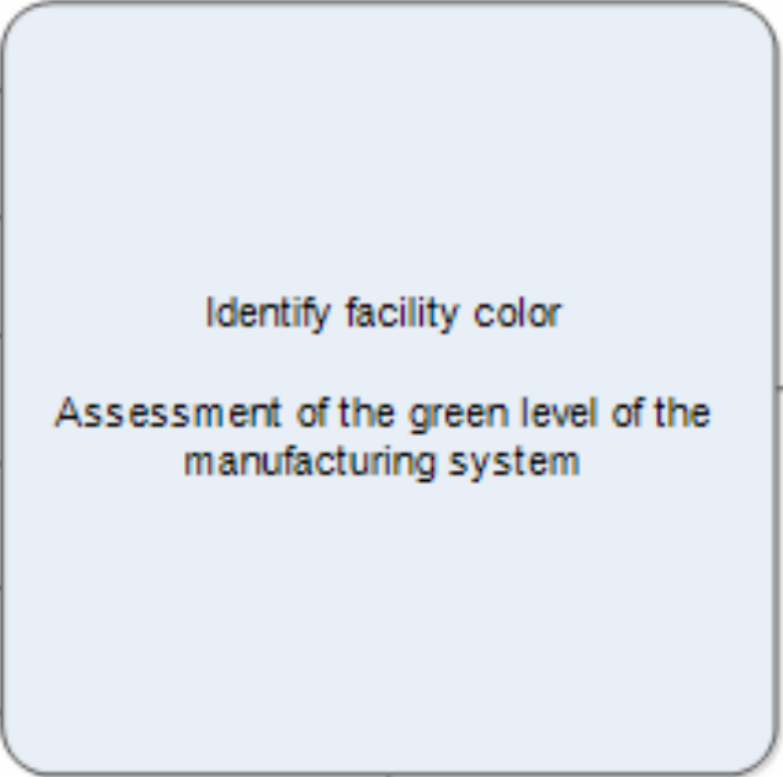
# Model Development

- A range for each color (level) was determined:
  - Black: All required points and total points of (0-1.4 points)
  - Gray: All required points and total points of (1.41-3.4 points)
  - Brown: All required points and total points of (3.41-4 points)
  - Green: All required points and total points of (4.01-5.00 points)



Quantitative assessment

- Water level
- Waste level
- Transportation Level
- Safety & Human factor level
- Landscape and Site management level

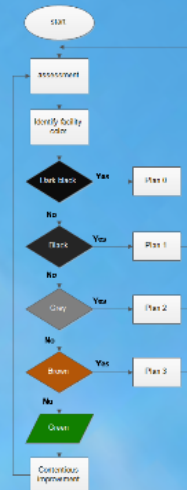


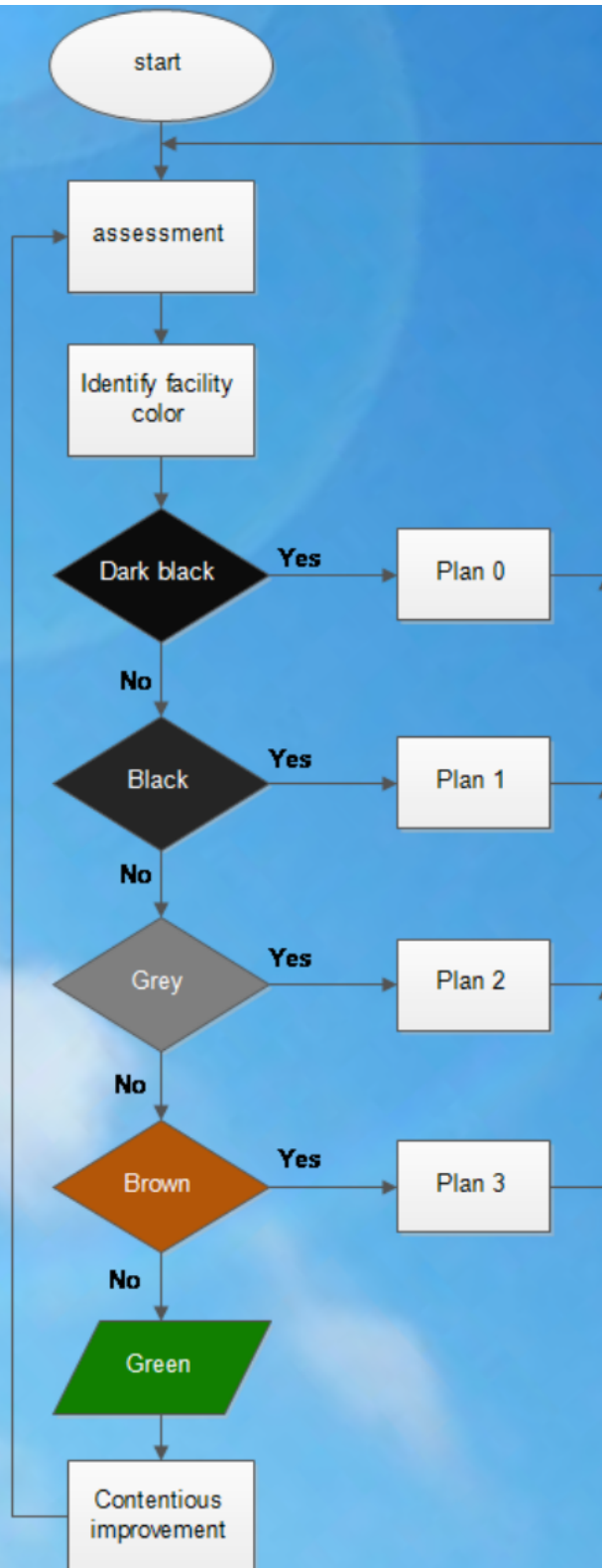
Assessment Score :  
Dark Black, Black, Grey, Brown and Green

# Model Development

## 2. Improvement areas identification:

- "Green improvement" plan is generated depending on the firm level (color).
- In order to improve the firm's color, a procedure should be followed and four different to-do-lists have been developed.





# Model Development

## 2. Improvement areas identification:

### To Do List 0

- Defining source of water.
- Achieve a minimum of 60% of the water accounted in the inventory for processing operations is reused.
- Activity tracking and management program in place for continuous improvement and data collection.
- Defined source of energy.
- Implementing a waste management plan which lead to reduction in the generated scrap.
- Every employee is included in the insurance.
- The processing area (cutting) is three way surrounded.
- Facility area is pounded with walls.

### To Do List 1

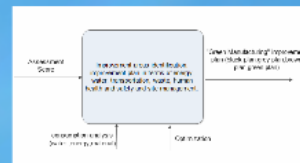
- Existence of documented instructions to Enhance water conservation.
- List of vendors.
- Distance and location of the supplier is taken into consideration.
- Size of the truck is taken into consideration.
- Number of shipments and number of blocks per shipment is taken into consideration.
- Energy consumption is taken into consideration when purchasing a new machine.
- Achieved (50% -69%) reduction of solid waste inventory.
- Ventilation system.

### To Do List 2

- The company has a mechanism to collect rainwater.
- 61% -79% of the water accounted in the inventory for processing operations is reused.
- Existence of techniques to Enhance water conservation.
- Certain measures have been taken to enhance energy conservation.
- Characterize the scrap according to its nature (e.g. stone slabs, shrapnel ... etc).
- Carefully design and measure cuts to minimize scrap.
- Implement strategies to reuse, recycle, sell or create new products from the scrapped material in order to decrease the amount of wastes.
- Follow regulations (environmental friendly way) when disposing yielded waste that cannot be given a second life.
- Achieved (70%-89%) reduction of solid waste inventory.

### To Do List 3

- Total collected rainwater represents 30% of the water inventory.
- 80% or more of the water accounted for the inventory for processing operations is reused.
- Usage of green materials for packaging.
- The firm has renewable energy resource.
- Office waste reduction.
- Achieved (90% -100%) reduction of solid waste inventory.
- Enhanced sludge management: diversion of sludge to environmentally friendly material or reuse applications.
- Employees should wear safety equipments.
- Level of noise.
- Level of dust.
- Periodical examination of workers.
- Facility includes some green areas (Trees).
- Facility roads and external areas are paved.



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Assessment  
Score

Improvement areas identification:  
improvement plan in terms of energy,  
water, transportation, waste, human  
health and safety and site management.

"Green Manufacturing" improvement  
plan (black plan, grey plan, brown  
plan, green plan)

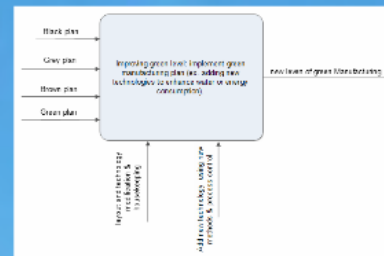
consumption analysis  
(water ,energy,material)

Optimization

# Model Development

## 3. Improving green Level:

- A structured methodology should be developed in which its implementation should be gradual to insure not affecting productivity.
- During the implementation of the green manufacturing plan at each level (to-do-list), a reassessment process using the developed green manufacturing checklist should be carried out.
- The reassessment process will measure the green improvement degree at various manufacturing levels achieved through the checklist.

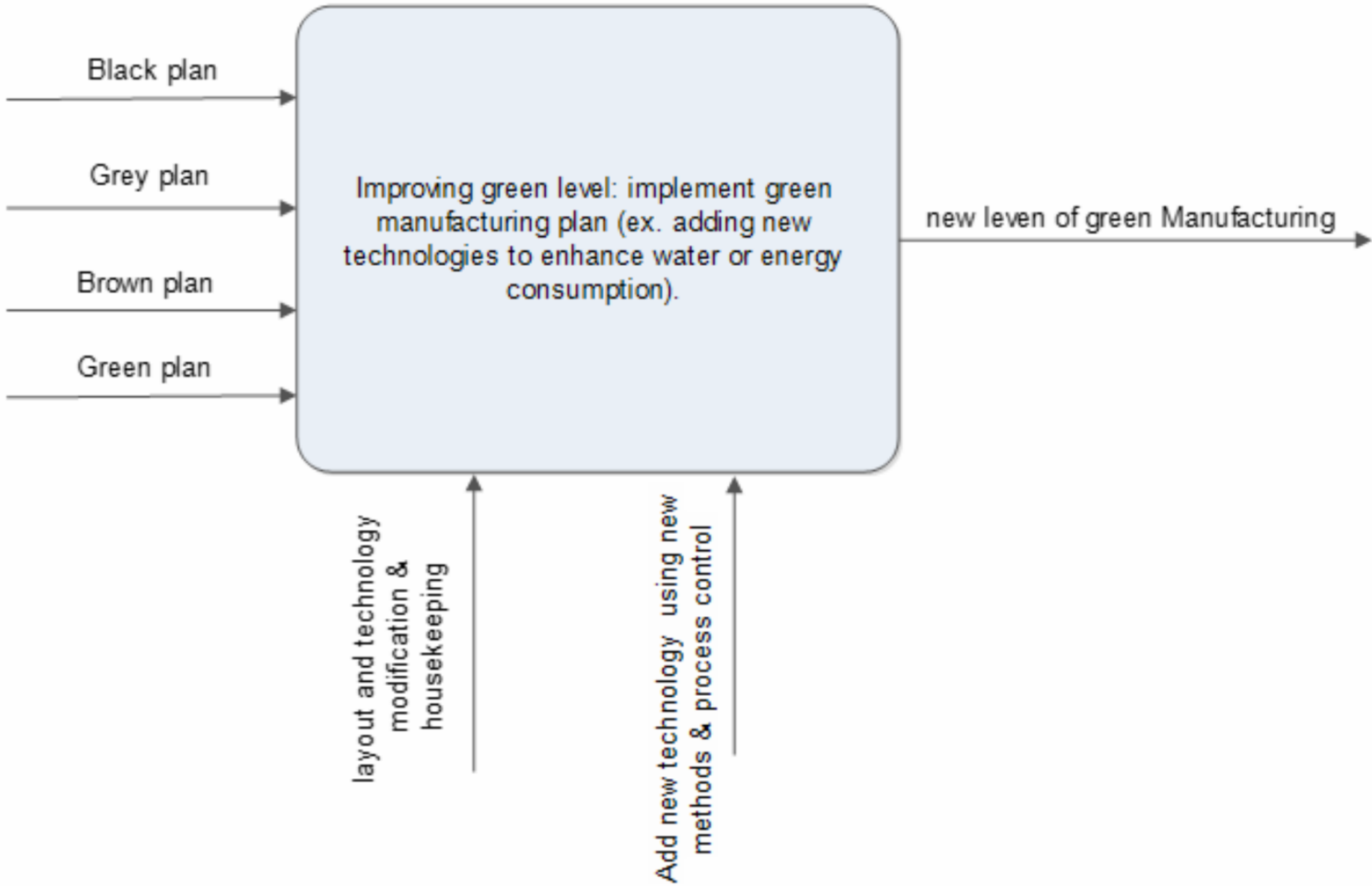


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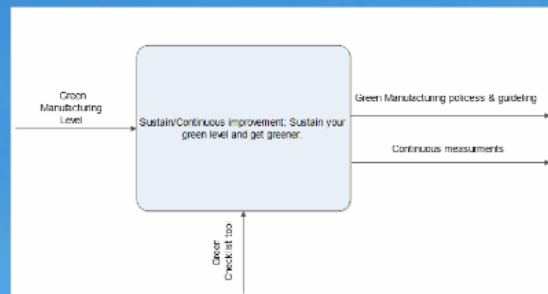
- The objective of the current color



# Model Development

## 4. Continuous improvement:

- In order to insure that the improvements done before at a certain level are still implemented by continuously check the terms in the current level plan.



- This model has k sustainability con shows how to impr

Green  
Manufacturing  
Level

Sustain/Continuous improvement: Sustain your  
green level and get greener.

Green Manufacturing polices & guideling

Continuous measurments

Green  
Checklist tool

## Conclusions and Recommendations

- The results of this initial study with regard the sustainability awareness level was not as poor as it was expected considering the very special political conditions of Palestine and being one of the very developed countries.
- The level of awareness can be qualitatively considered low as the practical activities (i.e. sustainability laws, projects, initiatives, etc.) considered very limited when compared to other countries in the region.
- The sample of the young educated community, represented by the university students, showed passive perceptions towards sustainability and lack of awareness as well.

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## Conclusions and Recommendations

- The special condition and difficult challenges in Palestine can be a source of innovative sustainability solution to compensate for resource scarcity especially in the situation where advanced technology is not necessarily required.
- The sustainability level, in general, was poor due to the lack of awareness, resources, random disposal of waste, the financial issues due to the decreased demand in many areas and finally the occupation which cause limited resources.

## Conclusions and Recommendations

- The southern areas; Bethlehem and Hebron, suffers a low water level.
- the Stone and Marble industry should improve its current level by implementing the proposed lists in order to reach an efficient-use of available resources which will lead to higher profit that will contribute in improving the whole industry.

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# The End

Thanks for listening