Tropentag 2020

Czech University of Life Sciences Prague
Faculty of Tropical AgriSciences

Using SWOT- AHP approach in determining the dimensions of the investment in biogas technology and its location in Syria

Ghaith Hasan*, Jana Mazancova, Jan Banout, Hynek Roubík,

Czech University of Life Sciences, Faculty of Tropical AgriSciences, Czech Republic

Faculty of Tropical AgriSciences

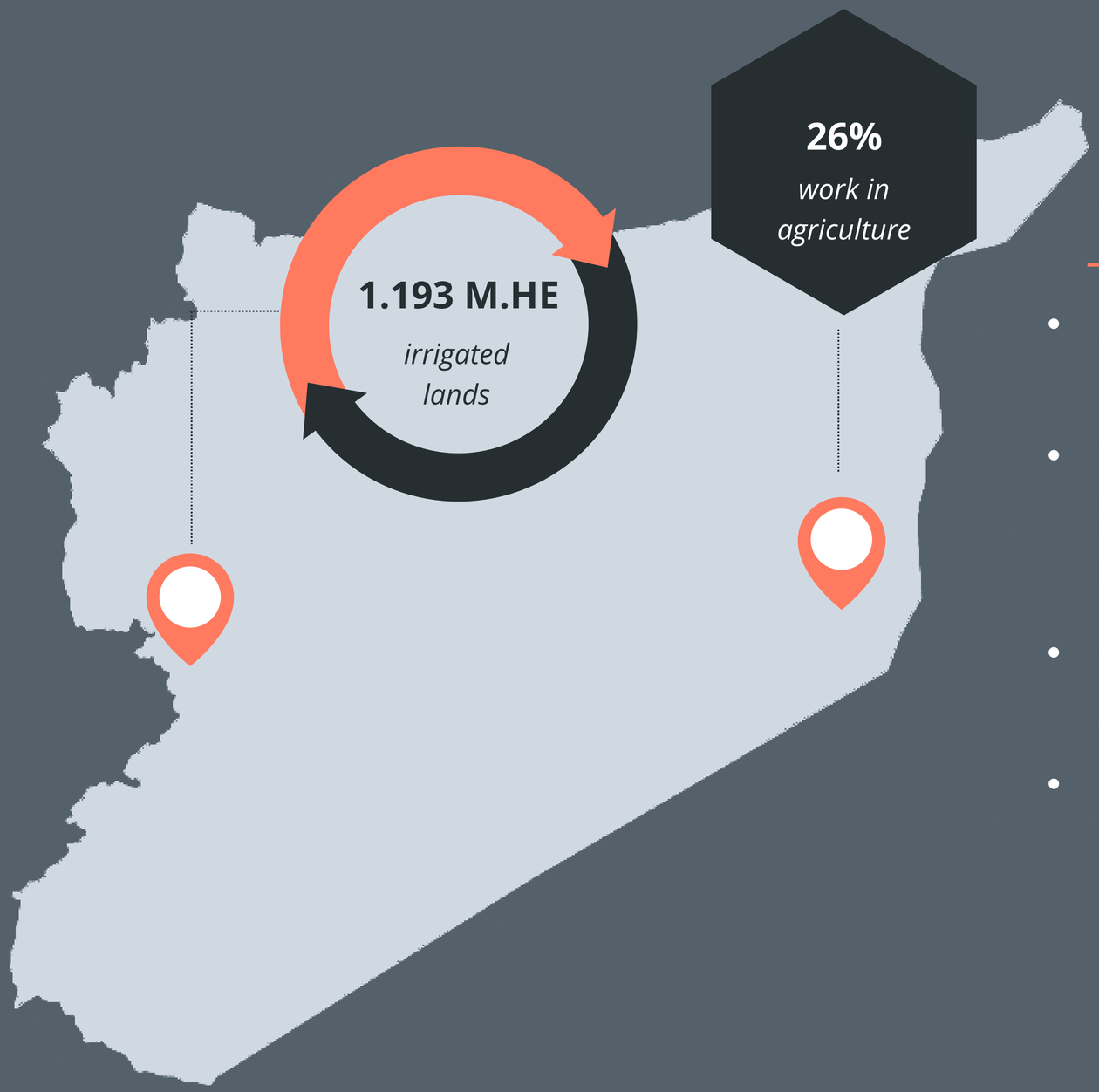
Ghaith Hasan

Department of Sustainable Technologies, Faculty of Tropical AgriSciences, Czech University of Life Sciences Prague, Kamýcka 129, Prague - Suchdol 16500, Czech Republic (hasan@ftz.czu.cz, mazan@ftz.czu.cz, banout@ftz.czu.cz, roubik@ftz.czu.cz)

Email: *Hasan@ftz.czu.cz, Phone: +420 22438 2508
Corresponding address:
Czech University of Life Sciences Prague,
Kamýcká 129, 165 00 Prague 6 – Suchdol,
Czech Republic

Acknowledgement

This research is totally being supported by the Internal Grant Agency of Faculty of Tropical AgriSciences (20205008) of Czech University of Life Sciences Prague.

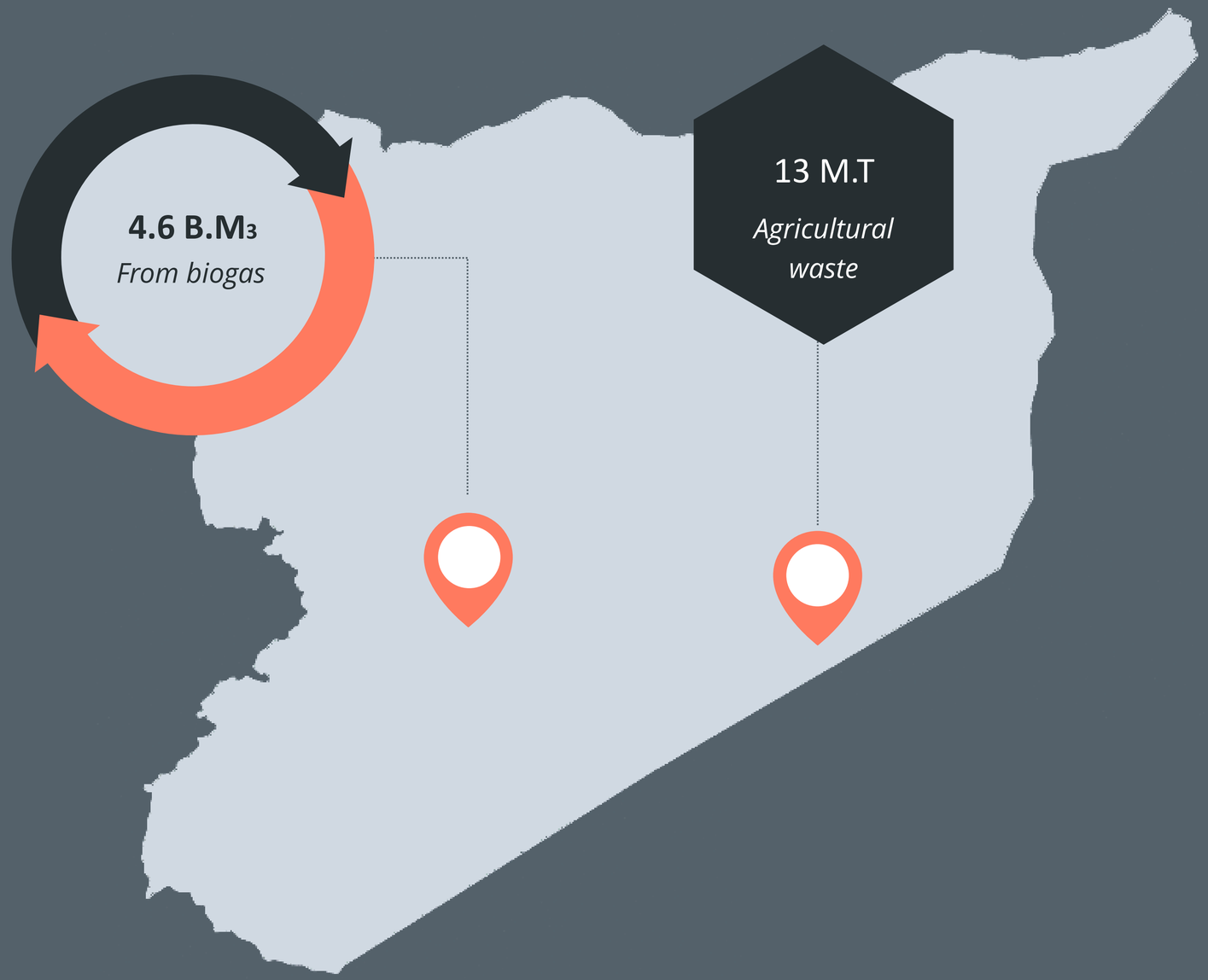


Introduction

- Agriculture in Syria occupies an important position.
- The area of agricultural land invested in Syria is 4.176 million hectares out of 6.083 million of which are arable.
- More than one million workers work in agriculture (26% of the Syrian workforce (2)).
- In 2019, the contribution of agricultural production to the national income increased from 17% to 39 % and that 60 % of total exports are agricultural products.

Introduction

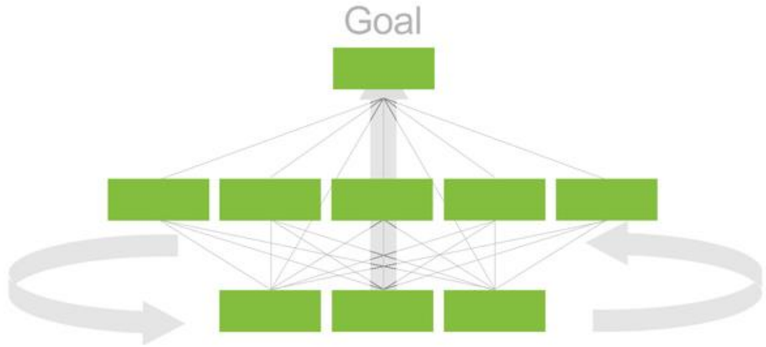
- The use of biogas production technology to treat all agricultural and animal wastes in Syria (which about 4.6 billion cubic meters of biogas can be obtained) is equivalent to producing 2.7 billion liters of diesel oil annually.
- The average annual Syrian production of agricultural waste amounted to 13 million tons in 2014 (3,4).



- Since the conflict erupted in Syria in 2011, solid waste collection services and disposal methods have been disrupted in many cities.
- Loss of oil derivatives, and severe international sanctions on the energy sector have caused energy

The importance of the research

- The importance of the research comes from being one of the few researches in Syria that sheds light on the production of biogas.
- The aim is to identify the best areas for investment in biogas technology through using two methods, SWOT analysis to determine the strategic dimensions that should be exploited and analytic hierarchy process AHP to propose the best area to invest in biogas production.

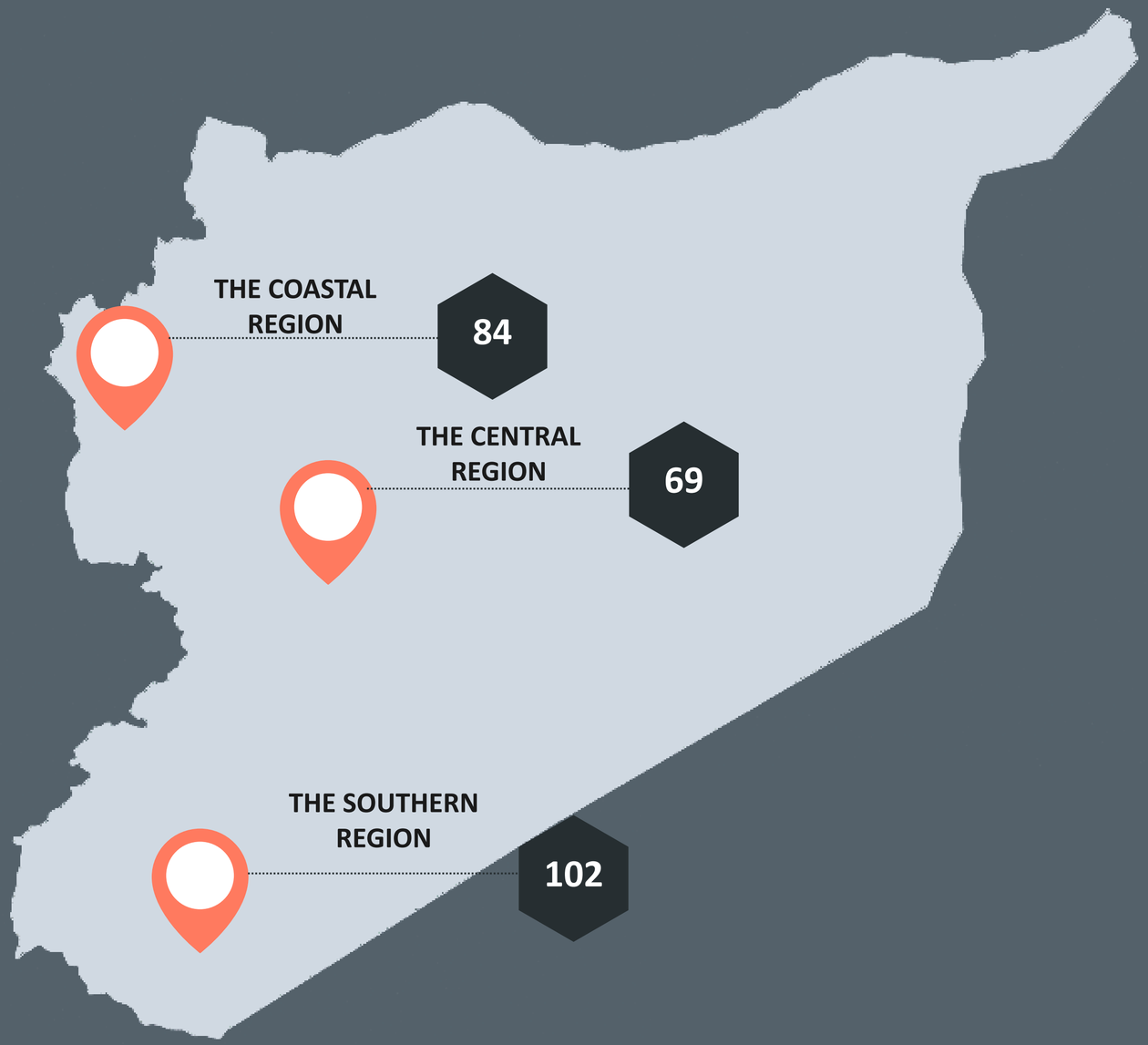


AHP

Materials and methods

THE DATA

The data was collected using a questionnaire at 300 farms.
255 of which were entered into the research with response rate of 85% and distributed in (84) farms in the Coastal region, (69) farms, in the Central region, and (102) farms in the Southern region.
The Survey applied in rural areas in the following provinces: Latakia, Tartus, Homs, Hama, Damascus, Sweida, and Daraa. This study covered approximately about 56.14% of Syrian territory, which represents areas that can be safely accessed.



Response average

100

100

Covered area

Materials and methods

The survey included the following main chapters:

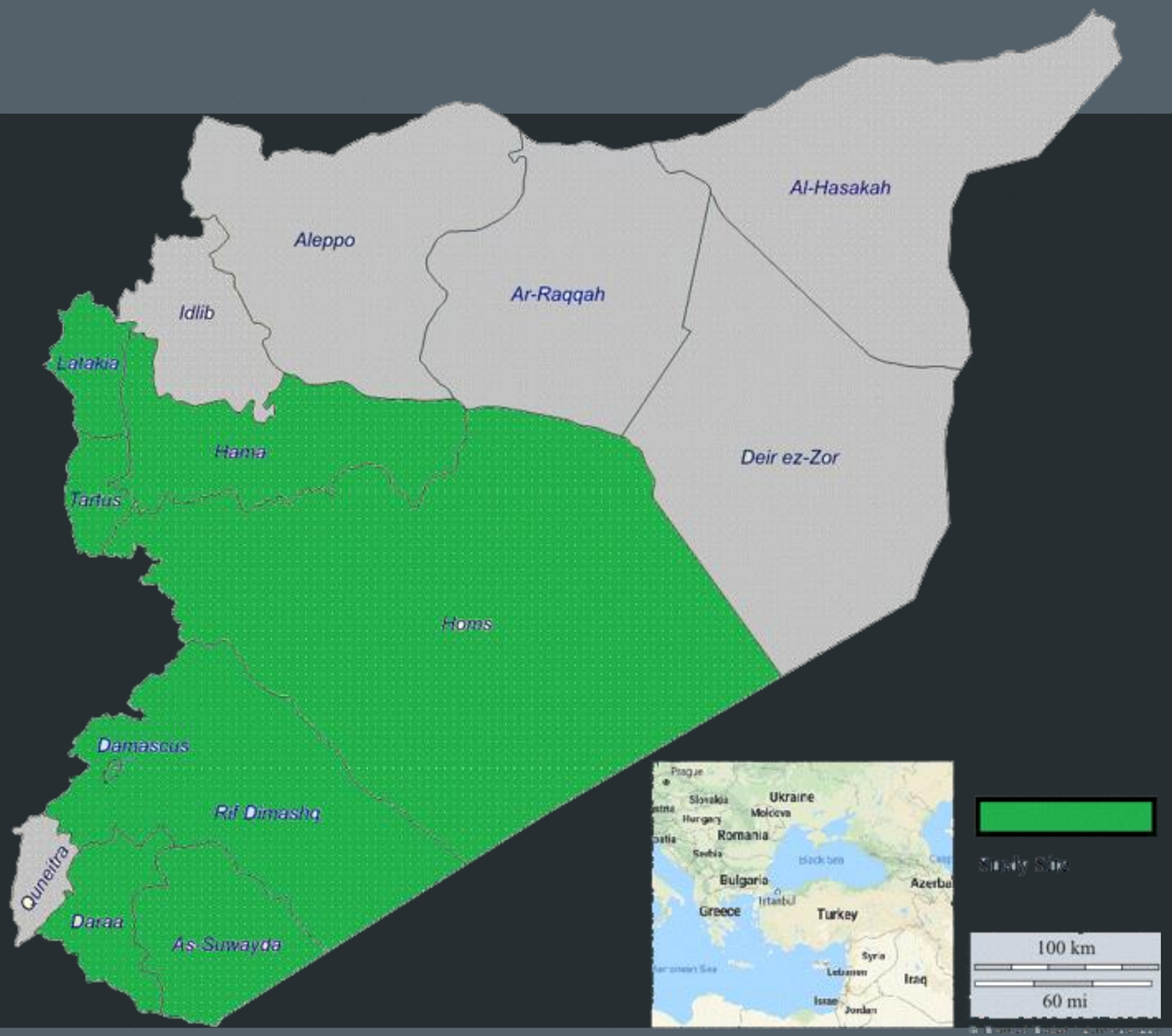
1 | *The first chapter includes the participant's knowledge about biogas and includes questions about the respondent's knowledge of the technology, its cost and how to produce it.*

2 | *The second chapter includes the extent of the participant's acceptance of the biogas technology and their desire to use it.*

3 | *The third chapter includes the respondent's approach to the use of biogas and the resulting organic fertilizer. It includes questions about the use of the energy produced from the biogas and the feasibility of using it.*

4 | *The fourth chapter includes the management aspects and includes questions about managing the biogas unit individually or collectively and whether the biogas units should be managed privately or under governmental management.*

5 | *Fifth chapter includes the financial aspects and includes questions about the yield of biogas technology and the costs of establishing a biogas unit.*



SWOT

The proposed criteria

S

-Attention to new innovations
-Prepare to separate organic waste (kitchen and garden waste) from the rest of the household waste
-Biogas technology reduces final waste volume
-Degradation of organic waste results in plant fertilizer
-The desire to use compost resulting from biogas technology in the home or farm garden

W

-The initial cost of constructing a biogas unit is high
-There are other alternatives better than biogas technology to treat organic waste
-Running a biogas unit at home or on the farm will require a lot of time and effort
-Concerns about the low quality of fertilizer resulting from the use of biogas technology.
-The energy produced from manure is not recommended for cooking

O

-Environmental impacts of biogas technology
-The use of biogas is economically and environmentally feasible
-Biogas technology is a suitable alternative to the energy source currently used
-The financial benefit of technology to the family
-The desire to participate collectively in the Biogas Management Committee

T

-Taxes
-The desire for the government to contribute to the cost of establishing biogas technology
-Fees
-In the event of acquisition of a biogas unit, there is a fear that it will not be able to maintain it in the event of a malfunction.
-In the event of acquisition of a biogas unit, there is a fear that no appropriate expertise will be available to follow up on the unit's operation and maintenance.

ANALYSIS

AHP

Analysis of multiple decisions AHP

- *One of the most important techniques used for decision making is AHP.*
- *The hierarchical analysis process plays an important role in choosing between several criteria.*
- *It is a widely used method for solving problems with MCDM systems.*
- *It converts the goal into a hierarchical series of criteria, where the criteria are arranged in a horizontal and vertical matrix in which each of the two criteria is compared separately in the so-called double comparison.*

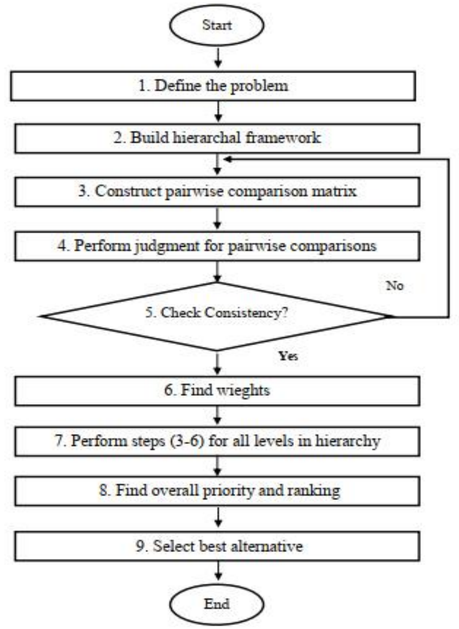
AHP is based on three basic principles:

(1) building a hierarchy of decision problem.

(2) setting priorities.

(3) achieving the principle of consistency.

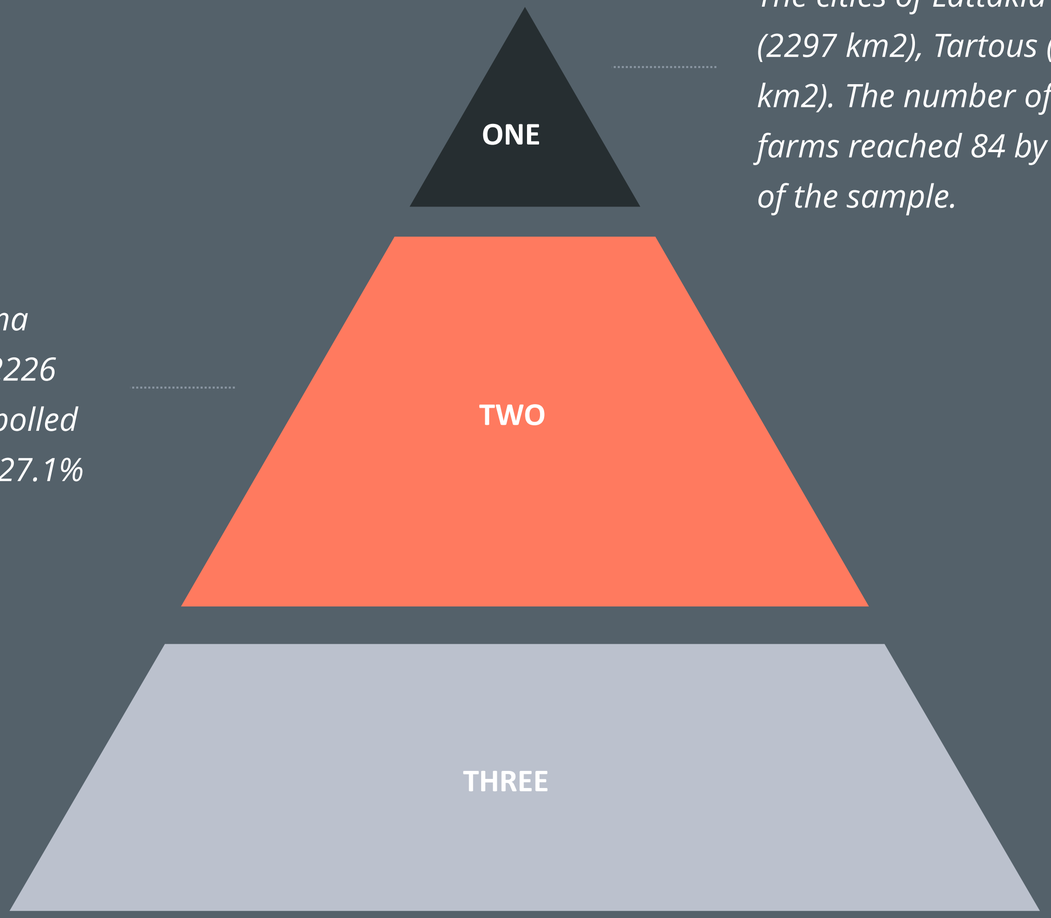
the flow chart of the method AHP.



AHP

Analyzing alternatives using the Analytic hierarchy process:

Three areas were chosen to establish a biogas unit, as we clarify it as follows:



Coastal region

The cities of Lattakia include (2297 km2), Tartous (1892 km2). The number of polled farms reached 84 by 32.9% of the sample.

Central Region

The cities include Hama (8880 km2), Homs (42226 km2), the number of polled farms reached 69, or 27.1% of the sample.

Southern Region

The cities of Damascus include (105 thousand km2), Damascus countryside (18018 km2), Daraa (4000 km2), and As-Suwayda (5550 km2), the number of surveyed farms reached 102 by 40% of the sample,

AHP

The average response

Southern Region

The average response to this area was 4.08, with a relative weight of 81.53%.

Central Region

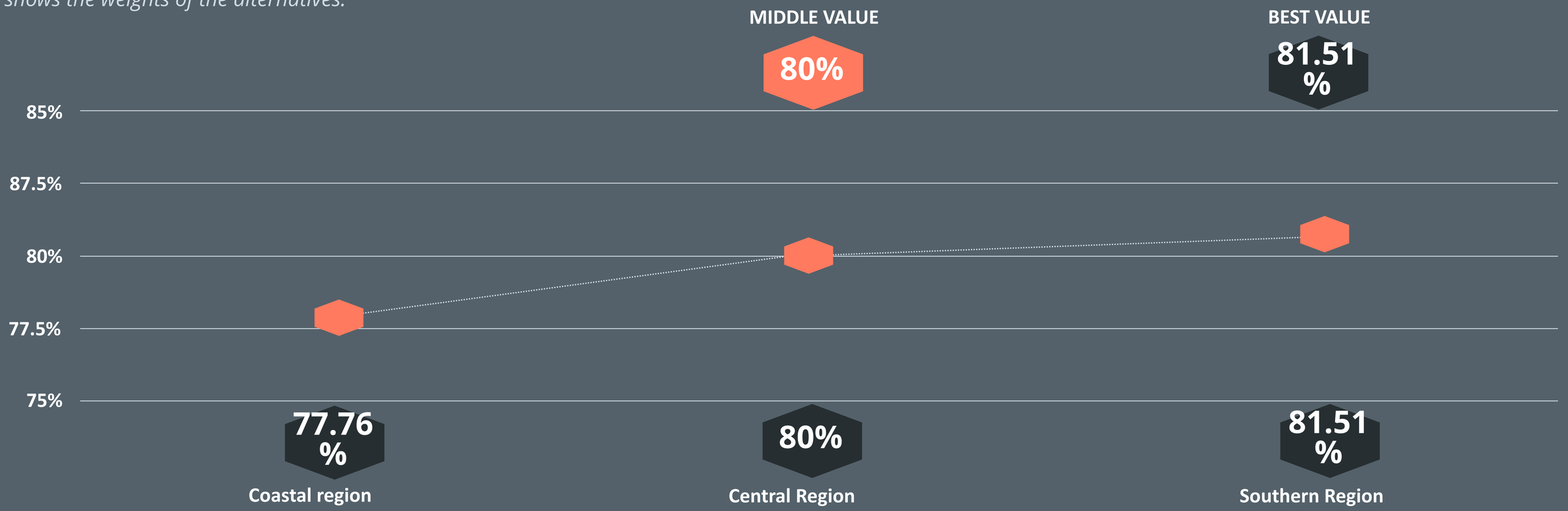
The average response for this area was 4, at a relative weight of 80%.

Coastal region

The average response to this area was 3.89, with a relative weight of 77.76%.

CHARTS

shows the weights of the alternatives:



Standards:

Matrix of binary comparisons:

	M1 (*participant's knowledge)*	**M2** (*participant's acceptance)*	**M3** (*use of biogas and the resulting organic fertilizer*)	**M4** (*management aspects)*	**M5** (*financial aspects)*
M1 (*participant's knowledge)*	1	2	0.142	0.2	0.5
M2 (*participant's acceptance)*	0.5	1	0.111	0.142	0.333
M3 (*use of biogas and the resulting organic fertilizer*)	**7**	**9**	**1**	**2**	**3**
M4 (*management aspects)*	5	7	0.5	1	0.5
M5 (*financial aspects)*	2	3	0.333	2	1

Standards:

Natural matrix:

	M1 (*participant's knowledge)*	**M2** (*participant's acceptance)*	**M3** (*use of biogas and the resulting organic fertilizer*)	**M4** (*management aspects)*	**M5** (*financial aspects)*	**average**
M1 (*participant's knowledge)*	0.064	0.090	0.068	0.037	0.093	**0.071**
M2 (*participant's acceptance)*	0.032	0.045	0.053	0.026	0.062	**0.044**
M3 (*use of biogas and the resulting organic fertilizer*)	**0.318**	**0.409**	**0.479**	**0.374**	**0.562**	**0.428**
M4 (*management aspects)*	0.322	0.318	0.239	0.187	0.093	**0.232**
M5 (*financial aspects)*	0.129	0.136	0.159	0.374	0.187	**0.197**

Alternatives:

Matrix of binary comparisons:

	southern	central	coastal
southern	1	2	3
central	1/2	1	3/2
coastal	1/3	2/3	1
TOTAL	**1.83**	**3.67**	**5.5**

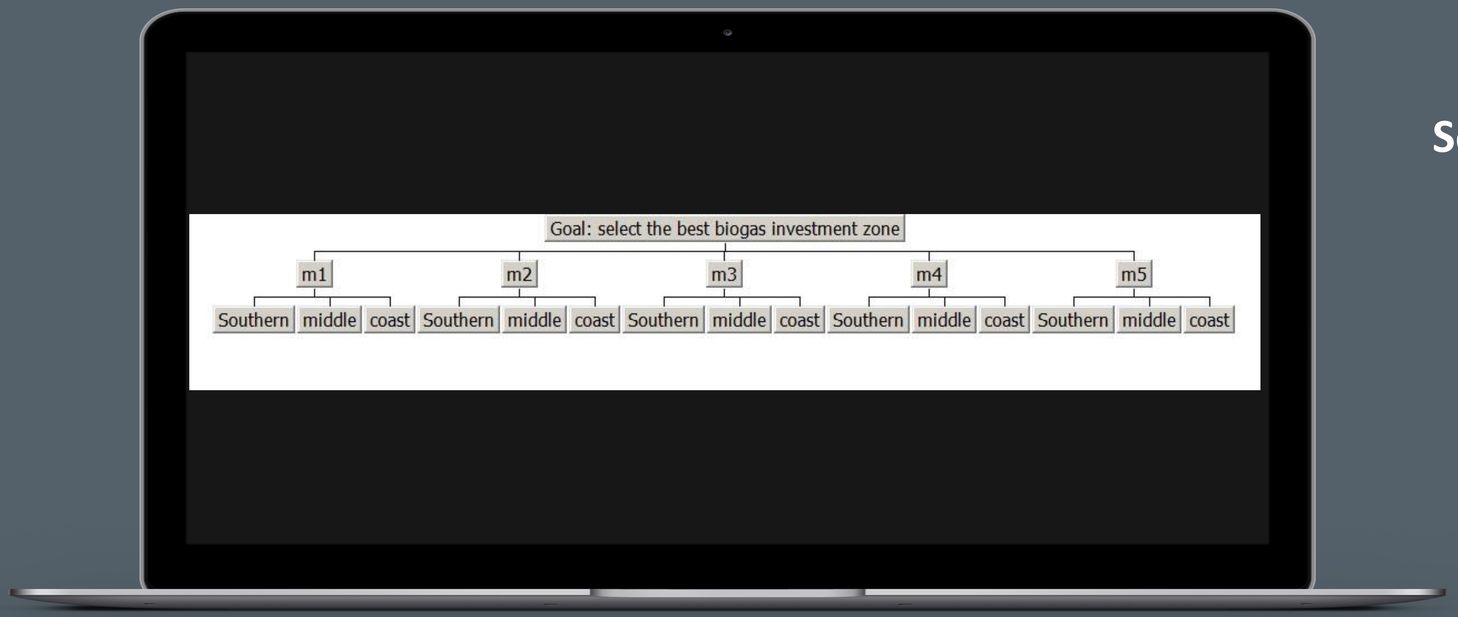
Alternatives:

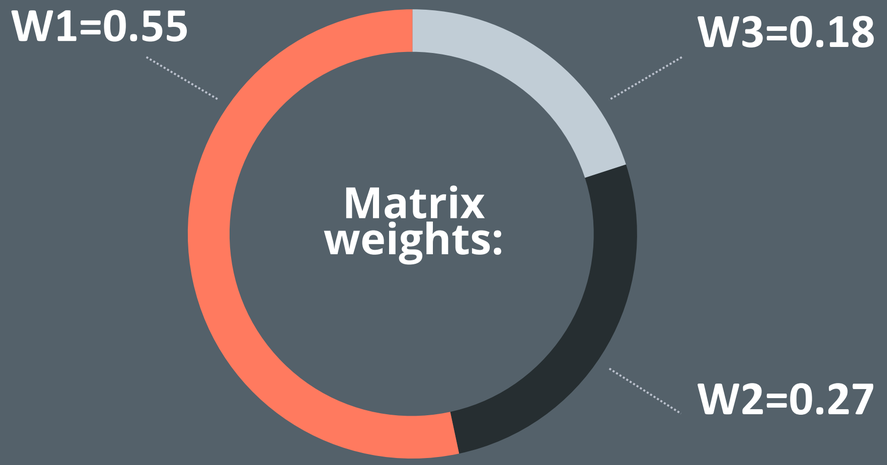
Natural matrix:

	southern	central	coastal
southern	0.55	0.55	0.55
central	0.27	0.27	0.27
coastal	0.18	0.18	0.18
TOTAL	1	1	1

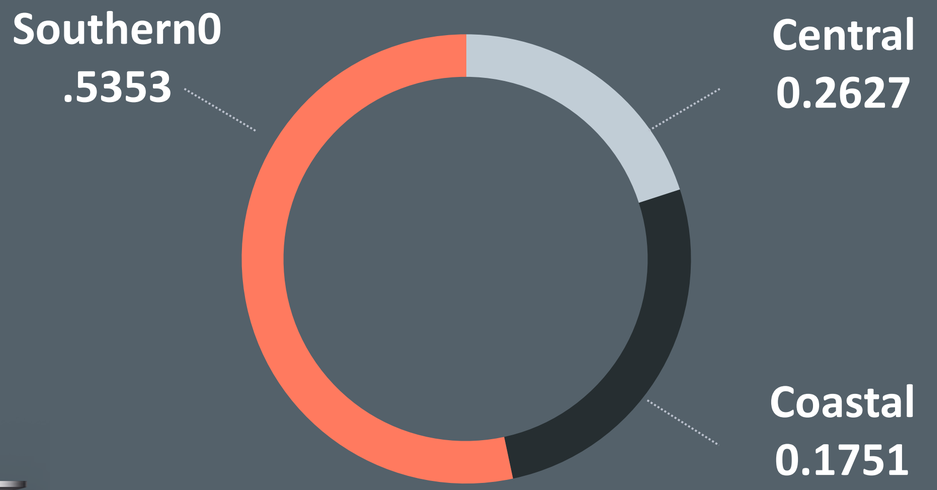
AHP

- Therefor, the decision is to choose the alternative (the southern region) as an important region for investment in biogas units.
- EXPERT CHOIC program was used to perform the analysis and the following diagram shows the scheme of alternatives:





We multiply the precedence of criteria by the precedence of alternatives



AHP

The following figure shows the marital comparisons of the main criteria:

From the figure, it is clear that the main criterion that has the highest importance among other major selected criteria, which is the standard m3 (the common approach for the use of biogas and the resulting organic fertilizer) at 45.4% of the importance.

AHP

The following figure shows the marital comparisons of alternatives:

From the figure it is clear that the main alternative that gained the highest importance among other alternative criteria is the southern region by 54.5.

Results and proposals:

- *The best strategy is to exploit strong opportunities based on the available strengths, which is the Syrian society's acceptance of the technology and the desire to use it for their awareness of the benefits of this technology.*
- *On the other hand, the most important threats are fees and therefore we recommend financing rentals for these projects and exempt them from taxes and fees.*
- *The common approach for using biogas and the resulting organic fertilizer is the best among the criteria in the study of locating a biogas unit production, with a weight of 82.6% in the southern region, 81.2% in the central region, and 79.60% in the coastal region.*
- *The main alternative that gained the highest importance among other alternative standards is the southern region by 54.5%, the second alternative the central region at 27.3% and the last alternative the coastal region 18.2%.*
- *There is an urgent need to adopt multi criteria decision making analysis methods and methods in making decisions with multiple objectives or criteria in determining optimal investments.*

Thank you for your attention!

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