



## **Assessment of the initial social impact to determine and manage the intended and unintended social consequences that climate change has over agriculture at municipal level**

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**“INTEGRATING SOCIAL DIMENSIONS INTO AGRI-CLIMATE CHANGE ADAPTATIONS”  
2022-1-MK01-KA220-ADU-000086031**



This assessment was done as part of the Erasmus+ project “Integrating social dimensions into agri-climate change adaptations” - 2022-1-MK01-KA220-ADU-000086031.

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Assessment of the initial social impact to determine and manage the intended and unintended social consequences that climate change has over agriculture at municipal level

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НАЦИОНАЛНА АГЕНЦИЈА  
ЗА ЕВРОПСКИ ОБРАЗОВНИ  
ПРОГРАМИ И МОБИЛНОСТ



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## Acknowledgments

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In essence, this assessment, while bearing the mark of many hands and minds, is a testament to the power of collaborative effort. Each contribution, big or small, has been a vital thread in the tapestry of this research, and for that, we are profoundly grateful.



## Introduction

The assessment we present here is an integral component of the ambitious project titled "Integrating Social Dimensions into Agri-Climate Changes." At its core, this project seeks to bridge the critical gap between climate change adaptations and the social dimensions that underpin them, specifically at the local level. Climate change is a reality that is already impacting and will continue to reshape the daily lives of individuals, influencing their work, livelihoods, health, housing, access to water, food security, and nutrition. As the world grapples with these challenges, it becomes imperative to consider the profound social implications that accompany them.

This project is designed to actively engage local farmers in identifying climate change-related challenges and empower them to play a central role in the decision-making processes for adaptation strategies. By involving the farming communities directly, our aim is to ensure that our climate change adaptation measures are related with the genuine needs of those most affected. Rural populations are expected to bear the brunt of climate change effects, primarily due to their heavy reliance on the very natural resources most vulnerable to climate-related shifts. Moreover, they often possess limited resources to protect themselves, adapt, or recover from losses. Effective policies and actions to address these impacts will hinge on the transformation of the social and economic connections that contribute to vulnerability.

The specific objectives of this project are to:

- Provide knowledge and skills to the agricultural sector to facilitate adaptation to climate changes.
- Analyze the social aspects and consequences of climate change on agriculture at the municipal level.
- Foster local cooperation on climate-related issues.
- Prioritization of climate change issues within the agricultural sector.
- Enhance the integration of social dimensions into local strategies and programs for adaptation to the climate changes.

To accomplish these goals, we have developed an approach that has multiple dimensions, including:

- **Assessment of the Initial Social Impact:** This assessment, which is the focus of this report, is dedicated to evaluating the anticipated and unintended social consequences of climate change on agriculture at the municipal level. It covers a wide range of factors, from the sensitivity of crops to climate change, the effects of disease on crops to the impacts of climate change on farmers, disaggregated by gender and age, as well as projections related to migration, agricultural employment, health, security food and nutrition, gender dynamics, age demographics and the well-being of small-scale farmers. This assessment serves as a crucial initial step towards realizing the overarching objective of the project, providing a detailed analysis of the social drivers of vulnerability and their impact on farmers and agriculture within the municipality. It leverages assessment tools to accurately identify problems, including those stemming directly from climate change.



- **Development of Prototype Municipal Strategy:** As part of the project, we will develop a prototype Municipal Strategy for Climate Change Adaptation measures in Agriculture. This strategy, besides for the municipality for Rosoman, but also for other municipalities will serve as a practical blueprint for municipalities seeking to ways and methods to address climate change impacts within their agricultural sectors.
- **Reduction of barriers and constraints to the involvement of farmers in processes of adaptation:** We will also work on the reduction of the barriers and constraints to the involvement of farmers in processes of adaptation of climate changes with filling in the educational gaps that the farmers have regarding the climate changes. This will be done with a creation of a training programme for climate changes adaptation measures for farmers.
- **Integration Guideline for Social Dimensions:** We will also develop Integration Guidelines for embedding social dimensions into agri-climate change adaptation planning and decision-making processes at the municipal level. These guidelines, besides for the municipalities, will also provide a structured framework for other municipalities to ensure that social considerations are interwoven seamlessly with climate adaptation efforts.

This assessment falls within the scope of Work Package 2 (WP2) of the project, which primarily centers on creating a detailed assessment of the projected social impacts at the local community level, with a specific focus on the agricultural sector. The assessment takes into account a wide range of factors, including the sensitivity of crops to climate change, the effects of disease outbreaks, the impacts of negative consequences on farmers and migration trends. Furthermore, it explores the long-term consequences on employment, health, food security and nutrition, gender equality, age demographics and the livelihoods of smallholder farmers.

By conducting this assessment and addressing knowledge gaps around climate change and adaptation measures in the agricultural sector, the aim is to contribute to a collective understanding of climate change and its impact on local communities and agriculture. Our goal is to empower municipalities and stakeholders with the knowledge needed to make decisions, and chart a sustainable path to address the challenges arising from climate change.





## Scope of the assessment

The scope of this assessment is comprehensive, aiming to provide an in-depth understanding of the social impact of climate change on agriculture at the municipal level. Building upon the overarching goals and objectives outlined in the project "Integrating Social Dimensions into Agri-Climate Changes". This comprehensive assessment falls within three main categories, each with its respective subcategories and specific questions, designed to provide a comprehensive understanding of the complex dynamics:

### 1. General Effects of Climate Change:

- a) Effects of climate change on agricultural practices
- b) Effects of climate change on the cultivated crops

### 2. Social Drivers and Social Impacts of Climate Change over Farmers and Agriculture:

- a) Impact of the expected effects of climate change on farmers at different levels of age, sex, and migration policies
- b) Underlying causes of damage caused by climate change in the agricultural sector
- c) Effects of climate change on employment, health, food and nutrition security, and small-scale farmers.

### 3. The Knowledge Gap of Local Farmers among Agriculture Related Practices:

- a) Climate Change
- b) Adaptation and Mitigation Measures
- c) Available Products/Resources
- d) Agricultural Technology
- e) Social drivers/Social Impacts

These categories and subcategories serve as the framework for our assessment, allowing us to systematically explore and analyze the intricate relationship between climate change and agriculture in Rosoman.

To accomplish this assessment, we engaged with diverse target groups, including farmers, agricultural professionals, natural resource professionals, and policy makers. By involving a wide range of stakeholders, we aim to capture a holistic perspective that reflects the varied interests and concerns within the local community.



## Importance of Assessing Social Impact in Agriculture

Assessing the social impact of agricultural practices and policies is of paramount importance for several compelling reasons:

- **Human Well-Being:**

Agriculture is not just about producing food; it profoundly affects the well-being of millions of people. Assessing the social impact helps ensure that agricultural activities enhance human lives by promoting food security, livelihoods, and overall quality of life.

- **Equity and Inclusivity:**

Agriculture is a key source of income and employment for the population, particularly in the rural areas. By assessing social impact, we can identify disparities and work toward equitable and inclusive agricultural systems that benefit all, regardless of gender, age, or socioeconomic status.

- **Food Security:**

The social dimension of agriculture is tightly linked to food security. Assessments help us understand how agricultural practices and policies impact food availability, access, and utilization. This knowledge is crucial for preventing the manifestation of hunger and malnutrition.

- **Rural Development:**

Agriculture often serves as the backbone of rural economies. Assessing social impact supports rural development efforts by identifying areas where investments can foster economic growth, infrastructure development, and improved living conditions.

- **Climate Resilience:**

Agriculture is vulnerable to climate change, and its social impact assessment can guide adaptation strategies in the agriculture. Understanding how climate-related factors affect farmers and communities is essential for building resilience and sustainable agricultural practices.

- **Gender Equality:**

Agriculture is a sector where gender disparities are often pronounced. Assessing social impact allows us to address gender-specific challenges and promote the empowerment of women in agriculture.

- **Community Well-Being:**

Agriculture does not operate in isolation, but it interacts with communities and ecosystems. Assessments help us consider the broader societal context, preserving community well-being and environmental sustainability.

- **Policy Effectiveness:**



Social impact assessment for the relevant institutions that adopt agricultural policies and programs with specific objectives, enables the creation of evidence-based policies by assessing whether these policies achieve their intended results and make the necessary adjustments.

- **Informed Decision-Making:**

Farmers, policymakers, and stakeholders make decisions every day that affect agricultural practices. Assessing social impact provides them with data-driven insights to make informed choices that benefit both individuals and society.

- **Sustainable Development:**

Agriculture is a central pillar of sustainable development. Social impact assessments contribute to the achievement of Sustainable Development Goals by promoting environmentally friendly, economically viable, and socially inclusive agricultural systems.

Assessing the social impact of agriculture is not merely an academic research aimed at scientific goals, but it is a critical tool for ensuring that agriculture contributes positively to the well-being of communities, fosters sustainability, and helps address pressing global challenges, with special accent to food security, climate change mitigation and adaptation measures.



## Methodology

The essence of any research is the relevance of the methodology on which it is based. In order to understand the complex dynamics of the impact of climate change on agriculture in Municipality of Rosoman, a detailed, multidimensional approach was taken. The methodology was not only used to collect data, but also to ensure the relevance, comprehensiveness and representativeness of the data collected. The relevance, comprehensiveness and representativeness of the data collected is ensured by a combination of traditional research techniques with innovative strategies, ensuring the depth, breadth and accuracy of the data.

## Approach

Work package 2 was created with the vision of producing a comprehensive document with a detailed assessment at the local level. The focus was on understanding the effects of climate change on the agricultural sector. This comprehensive assessment was structured into three key categories: *visible effects of climate change, social impacts and consequences, and the existing lack of knowledge in the agricultural community about climate change*. By carefully breaking down these broad categories into specific subdomains, the goal was to create a clear picture of insights that offered both a macro and micro perspective.

## Data Collection Methods

To ensure the reliability of the research results, an instrument was used in which the following methods are represented:

### Semi-structured Interviews:

The qualitative approach through semi-structured interviews aimed to capture the human factor. Each interview, delivered within a specific framework, is designed to be a dialogue rather than a monologue. This format provided during the discussion of the key themes, enough space for the interviewees to share their unique stories, concerns and insights, enriching the database with life experiences and perceived perspectives.

### Survey:

Survey questionnaires were used to collect quantitative data. In the questionnaires prepared by the partner OMNIA, a precise sequential ordering of the questions was made. The purpose of the structured questionnaires is to capture the dimensions of climate change and its impact on agriculture. The



questionnaires covered a diverse range of stakeholders to get a clear picture of the community's collective conscience about climate change.

## Profiling of the data

In the vast specter of data, profiling and analysis act as the roadmap, guiding researchers towards meaningful insights:

### - Stakeholder Profiling:

Starting from the fact that each stakeholder group brings its unique perspective, stakeholder profiling was crucial. By categorizing and understanding each group's unique vantage point, whether it be the hands-on experiences of farmers or the strategic insights of policy makers, the assessment ensured a complete overview.

### - Climate Risk Profiling:

The nature of climate change requires a deep dive into the specific challenges posed to agriculture in Rosoman. By tailoring questions to the region's unique climate challenges, the study aimed to predict, potential threats and come up with an appropriate response strategy.

### - Agricultural Practices Profile:

Many practices are applied in agricultural production, which are more or less different from each other. By mapping current agricultural practices, the study aimed to measure their resilience and adaptability to the effects of climate change.

## Analyses Conducted

### - Descriptive Analysis:

A basic step in the research was the breakdown of basic statistical data from the collected data. This analysis ensures:

- A clear understanding of the demographics of Rosoman Municipality, including gender, profession, nationality, migration trends, income levels, and education level.
- Insights into the perception of climate change, its impact on agricultural practices, and the varying degrees of awareness about potential products and resources.

### - Correlation Analysis:

Correlation analysis was performed using both interview and questionnaire data. Through this analysis:

- A correlation was determined between factors like age, gender, income, education, and the perceived impacts of climate change.



- It was determined that certain demographic groups, like specific age brackets or income levels, may have differing perceptions and experiences related to the effects of climate change on agriculture.

- **Sentiment Analysis:**

The segment analysis was done using the data from the qualitative interviews. Through this analysis:

- The overarching sentiment of stakeholders, especially farmers, regarding climate change was deciphered.
- The prevailing attitudes, concerns, hopes, and aspirations of the participants with respect to the changing climate and its implications on agriculture were determined.

- **Gap Analysis:**

A crucial part of our research was identifying knowledge gaps. The data pointed out areas where awareness was lacking, specifically in the domains of climate change effects, adaptation measures, and the importance of education in coping with climate change.

This analysis was pivotal in understanding what areas need more focus, both in terms of policy and education.

- **Sensitivity Analysis:**

By evaluating the responses, especially from the qualitative interviews, we gauged how sensitive different stakeholder groups were to various facets of climate change. For instance, small-scale farmers might be more sensitive to minor climatic changes than large-scale agribusinesses.

- **Comparative Analysis:**

The combined analysis section helped in contrasting and comparing findings from different data sources. This analysis was particularly important in identifying commonalities, divergences, and unique insights across data from interviews, questionnaires, and literature reviews.



## Critical Data Elements

In the vast realm of research and analysis, especially when addressing multidimensional issues like the impact of climate change on agriculture, it becomes imperative to identify certain pivotal data points. These data points, often referred to as "Critical Data Elements" (CDEs), serve as the backbone of the research, providing both structure and direction to the assessment.

CDEs are not merely random pieces of information but are meticulously chosen based on their significance, relevance, and potential to influence outcomes. They are the linchpins that hold the vast mosaic of data together, ensuring that the research remains coherent, focused, and actionable. Whether it's understanding demographic nuances, gauging perceptions, or unraveling the intricacies of agricultural practices, these elements provide the foundation upon which meaningful insights are built.

In the context of our study in the municipality of Rosoman, these elements become even more important. They act as integrators, ensuring the complex interaction between climate change, social dynamics and agricultural practices. By delving deeper into the analysis of data collection instruments, the need to become familiar with critical data elements and their importance in shaping the assessment narrative emerges.

### Demographics:

- Gender: A foundational element to understand any societal distribution and its implications.
- Profession: Provides an assessment of the main occupations in Rossoman, especially those related to agriculture.
- Nationality: Provides insights into the diversity of the community.
- Migration Status: Provides insight into the essential understanding of mobility patterns, particularly in the context of climate change.
- Income Levels: A fundamental determinant of economic stability and its correlation with climate change perceptions.
- Education Levels: Provides insight into the essential understanding of the knowledge base and its impact on perceptions and actions related to climate change.

### Perception of Climate Change:

- Awareness Levels: Provides insight on how informed the community is about climate change effects.
- Impact on Agricultural Practices: Provides insights into the direct impact of climate change on agriculture and related practices.

### Agricultural Practices and Climate Change:

- Products/Resources Awareness: It provides information on the awareness about products or resources that might help mitigate climate change impacts.



- Usage of Products/Resources: Determining if there's a gap between awareness and actual implementation.
- Specific Products Used: Identifying the most common products or resources being utilized.

#### **Social Impact:**

- Impact by Age: Provides insight into understanding whether certain age groups are more affected by the implications of climate change.
- Impact by Gender: It provides information on whether there is a gender difference in experiencing the effects of climate change.
- Impacts on Health, Nutrition, Small-Scale Farmers, Employment, and Migration: Provides information on societal factors that might be influenced by climate change, crucial to formulating adaptive strategies.

#### **Adaptive Strategies:**

- Knowledge of adaptation measures: Provides information on the level of knowledge and preparedness of the community on measures to deal with climate change
- Awareness and use of adaptive products/resources: Provides insight into understanding the gap between knowledge and application.
- Availability of adaptive products/resources: Provides an assessment of the level of availability of required resources.

#### **Knowledge Gaps:**

- Effects of climate change: Ensures identification of areas where more awareness campaigns are needed.
- Adaptation measures: Provides insight into community awareness of how to mitigate the effects.
- Climate Change Education: Provides an evaluation of the current educational process in terms of disseminating knowledge about climate change.

#### **Stakeholder Opinions and Insights (from qualitative interviews):**

- Demographics of respondents: Provides insight into whether diverse representation is ensured.
- Opinions on climate change and its impact: Provides direct feedback from those most affected by climate change.
- Qualitative insights: Provides insight into personal experiences, challenges and aspirations related to climate change.
- Policy Gaps: Identifies areas where policy interventions may be needed.

#### **Combined Analysis:**

- Overlaps and divergences: Provides an understanding of overlaps and insights from different data sources.
- Municipal level analysis: Provides a focused view of the local implications of climate factors.





- Social dynamics and economic aspects: Provides insight into the broader social implications of the data collected.

Each of these data elements, while crucial on its own, played a part in painting a comprehensive picture of the situation in Rosoman Municipality. They served as the pillars upon which the entire research was constructed, ensuring a robust and holistic understanding of the topic at hand.



## Literature Review

### Location and Geography of Rosoman Municipality

Rosoman Municipality, established in 1996, was formerly a territory within the Kavadarci Municipality. Since its inception, it has carved out a reputation as one of North Macedonia's progressive municipalities.

Centrally located in Povardarie region and in the center of the Tikvesh valley, the municipality of Rosoman stretches from the northeast to the southwest along the Crna Reka river. It borders the municipalities of Kavadarci, Negotino, Gradsko and Chaska. The municipality has predominantly flat terrain, but there are also hilly and mountainous regions, with an average altitude of 140 meters, which places the municipality in one of the lowest regions in North Macedonia.

The municipality of Rosoman is spread over the Crna Reka valley, which expands into a wide basin and creates alluvial deposits (soils). To the southwest, the municipality is surrounded by hills with an altitude of 200-500 m. The highest point of the municipality is the peak at 1,005 meters (Rouen peak). On average, this area has a slightly higher altitude of 315 m with gentle slopes.

Geologically, the lower regions consist of sedimentary rocks. The Black River valley is marked by extensive alluvial deposits, while the surrounding hills have Pliocene and Eocene sediments. The west is geologically more diverse, with rocks from the Paleozoic to the Mesozoic period. The soils that are represented in this region are very favorable for the cultivation of vines and orchards and have a positive influence on obtaining quality grapes and fruits.

### Settlements and Demographics

The rural communities in Rosoman are predominantly agricultural and livestock production. In some of the settlements, a decline in population is observed due to urban migration, while in others such as Manastirec and Rosoman, population growth is observed. This growth is the result of changes in agrarian practices, geographical advantages and soil fertility. From a tourist point of view, the municipality has potential for rural and agro-tourism, especially wine tourism. Settlements such as Rosoman, Manastirets, Palikura and Trstenik, located near the R-106 road, have the best prerequisites for wine tourism. Settlements with a peaceful rural atmosphere are an excellent opportunity for recreational tourism.

#### Key settlements in Rosoman Municipality include:

- Rosoman
- Sirkovo
- Manastirec
- Palikura
- Kamen Dol
- Debrishte



- Ribarci
- Krushevica
- Mrzen Oraovec

### **Climate and Hydrography**

The municipality is located in the central part of Macedonia and in the immediate vicinity of the Vardar valley, where a mix of continental and Mediterranean climate is established. Summers are typically hot, sometimes exceeding 40°C, while winters are mild, with temperatures falling to -20°C. The average annual precipitation is 510 mm, and prolonged dry periods occur during the summer. However, the annual duration of solar insolation of about 2500 hours contributes to the creation of excellent conditions for growing vines and fruit crops.

The region also has an abundance of underground water, especially in the alluvial plains along the rivers Vardar and Crna Reka.

### **Agriculture in Rosoman Municipality**

The municipality of Rosoman boasts a rich agricultural heritage. The combination of the favorable geographical location, favorable climate and fertile soils make this region ideal for different application of agricultural practices in several agricultural activities. In this municipality, as with other parts of the Vardar planning region, agriculture is a significant subject/factor for the economy, and also for the livelihood of the population in Rosoman.

### **Land Utilization:**

Of the total area of Rosoman, a significant portion, approximately 3,406 hectares, is devoted to agriculture. This land is precisely segmented for different agricultural areas such as orchards, vineyards, arable land and orchards.

The orchards cover an area of 364 hectares. The influence of the Mediterranean climate, for fruits such as apples, peaches and cherries, makes the region of the municipality of Rosoman quite suitable for their cultivation. Also, the extended duration of the sun, solar insolation, on average about 2500 hours per year, guarantees the achievement of optimal maturity in the fruits, a good yield with excellent taste and a high content of nutrients.

Vineyards in the municipality occupy a large part of the arable land, about 944 hectares. The production of wine is deeply rooted in the history and culture of North Macedonia, and especially in the last few decades when it took a strong momentum in the municipality of Rosoman. Prolonged sunny days, combined with favorable geological and topographical conditions, ensure obtaining grapes with unique flavors, which ensure obtaining high quality wines that are highly sought after in the market.

The largest part of arable land with 1,968 hectares, however, includes arable land and gardening. This includes cultivation of field crops, vegetables and other crops. Favorable soil and climatic conditions create opportunities for growing multiple crops throughout the year, ensuring the availability of agricultural products in multiple seasons.



**Challenges:**

Despite the recorded advantages, agriculture in the municipality of Rosoman faces certain challenges. One of the most pressing challenges is the prolonged dry periods during the summer months and the occurrence of droughts. Summer droughts sometimes last up to three months, and can seriously affect crop yields.

However, the region is adapting to such climate challenges. Modern irrigation techniques, including drip irrigation, are increasingly used by farmers to mitigate the effects of these dry spells.



## Climate and climate changes in the municipality of Rosoman

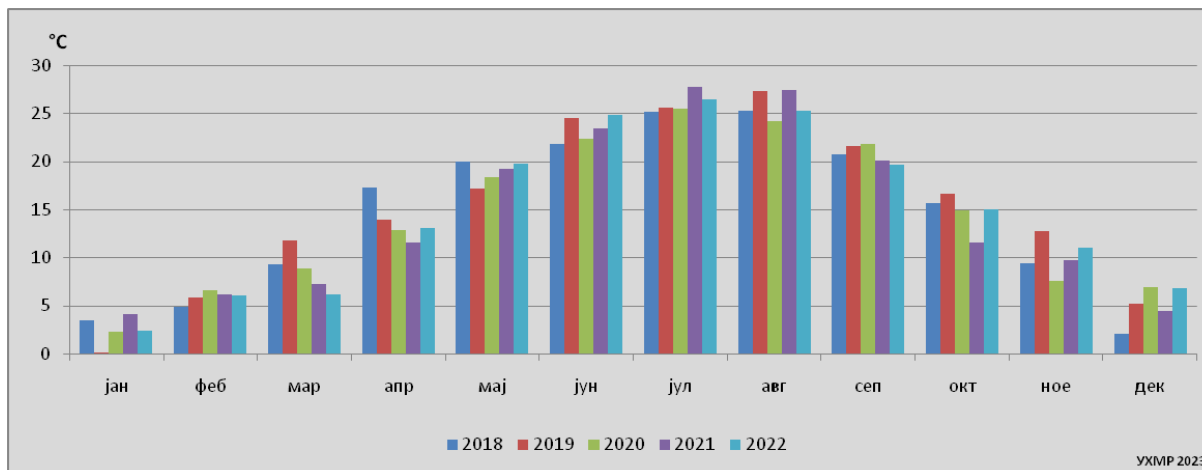
### Statistical data

In an attempt to obtain a comprehensive understanding of the climate changes occurring in the municipality of Rosoman, a request was submitted to the Administration for hydrometeorological services of the Republic of Macedonia for specific data and research on the topic. Unfortunately, direct research studies and targeted climate change data specific to Rosoman are not currently available. To facilitate our request, the Hydrometeorological Service has provided us with alternative data.

The submitted data were processed through the CLIDATA software package and were obtained from the Automatic Meteorological Station in Gradsko, Veles. This station, positioned at 41°34' north latitude and 21°56' longitude with an altitude of 197 meters above sea level, collects a range of meteorological information. The database covers a five-year period, spanning from 2018 to 2022, offering insight into prevailing weather conditions and potential trends indicative of climate change in the wider region that includes Rosoman.

Considering the nature of the current climate changes and their evident manifestations, the need for a more detailed and localized climate analysis for the municipality of Rosoman is recognized. In order to achieve this, there is a proposal from the Hydrometeorological Administration of the Republic of Macedonia to establish an automatic meteorological station directly within the municipality. This station would conduct meteorological measurements that adhere to the standards set by the World Meteorological Organization. Installing such a station would be a significant step towards accurately monitoring the local climate, analyzing the effects of climate change and formulating effective adaptation and mitigation strategies in response to these environmental challenges.

The municipality of Rosoman, located in the center of North Macedonia, represents a classic example of climate interaction, and of the gradual development and establishment of new relationships between climate factors due to global climate change. This points to the need for continuous monitoring and provision of relevant data on the impact of climate change, which are crucial for agricultural practices and the daily life of residents in the municipality of Rosoman.

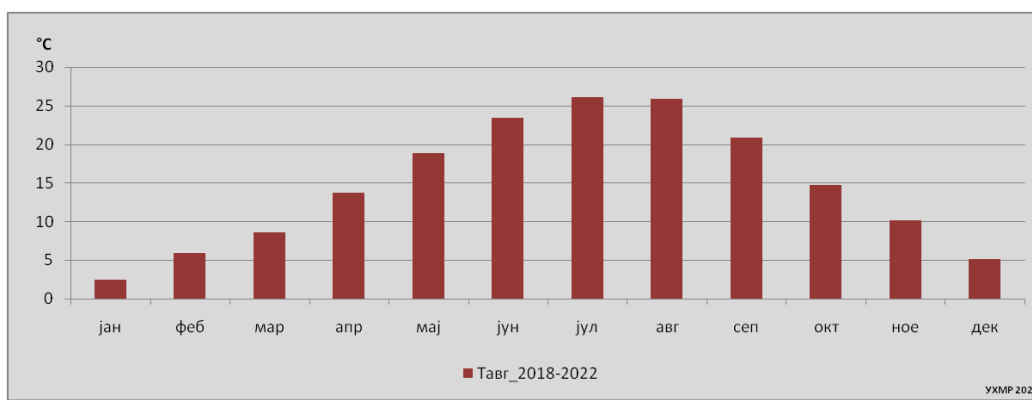


Display of average monthly air temperatures by year (°C)<sup>1</sup>

**Characteristics of climate for Rossoman:**

The location of the municipality of Rosoman near the Vardar Valley creates a mix of continental and Mediterranean influences. Summers are characterized by high temperatures, sometimes over 40°C. This prolonged heat, reinforced by an average annual duration of solar insolation of approximately 2,500 hours, and the application of appropriate agricultural practices, allow the successful cultivation of agricultural crops, especially the cultivation of vines. Winters are usually mild, with occasional extremes. Cold air masses from the north can sometimes cause temperatures to drop to -20°C.

Precipitation, although not abundant, averages about 510 mm per year, with the most precipitation occurring in May and November. Precipitation is not evenly distributed and most often in the summer months there are prolonged dry periods lasting up to three months.



Display of average monthly air temperatures (°C)<sup>2</sup>

<sup>1</sup> Administration for hydrometeorological services of the Republic of Macedonia, <https://uhmr.gov.mk/>

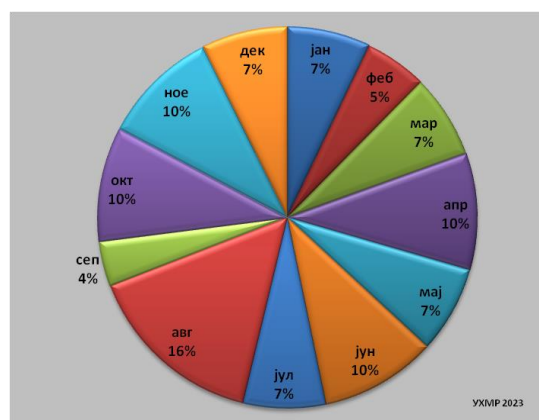
<sup>2</sup> Administration for hydrometeorological services of the Republic of Macedonia, <https://uhmr.gov.mk/>



### Manifestations of climate change:

Recent decades have brought remarkable changes in climatic conditions in Rosoman, mirroring broader trends in global climate change. Data from 2018 to 2022 indicate significant temperature variations, with extremes such as a record high of 42.2 °C and a low of -10.8 °C. This indicates a wide range of temperature fluctuations that may be indicative of the impacts of climate change.

Annual precipitation also varies significantly, from 314 mm in 2022 to 439 mm in 2020. Precipitation variability has a huge impact on local agriculture, water resources and ecosystem health. Extreme weather events, such as the maximum daily rainfall of 45.8 mm recorded on 27 August 2018, indicate changing climate patterns.



Percentage representation of precipitation by month for the period 2018-2022 <sup>3</sup>

### Prolonged dry periods:

Rosoman municipality traditionally has dry summers, but in recent years dry periods have become longer and more severe, as seen in the minimum annual rainfall in 2022. Such prolonged droughts can have devastating impacts on agriculture, especially in areas that lack irrigation conditions, and agricultural production is based on natural rainfall.

### Temperature fluctuations:

Like many places in the world, the municipality of Rosoman is exposed to unpredictable temperature changes. In the region, the occurrences of temperature extremes in summer and winter are characteristic, which are somewhat expected, since they are constantly present. However, the occurrence of unpredictable temperature variations, especially during transitional seasons such as spring and autumn, significantly disrupt the natural cycle of flora and fauna.

### Change in precipitation time:

<sup>3</sup> Administration for hydrometeorological services of the Republic of Macedonia, <https://uhmr.gov.mk/>

**“INTEGRATING SOCIAL DIMENSIONS INTO AGRI-CLIMATE CHANGE ADAPTATIONS”  
2022-1-MK01-KA220-ADU-000086031**



In addition to prolonged dry periods without precipitation, there are more and more recorded cases of unseasonal precipitation, which usually result in torrential rains and floods. Such unpredictability of rainfall can impair soil quality and harm crops.





## Agriculture and Climate Changes in Rosoman Municipality: A Preliminary Overview

Rosoman municipality, as part of Tikvesh region, represents an important segment of the agrarian in the region. And Tikvesh region, and therefore the municipality of Rosoman, are experiencing changes in agriculture in the last period, which should be harmonized with the impact of climate change. These changes are spontaneous, without being based on adequate knowledge and rarely encouraged and supported by specific institutions. It is vital to note that specific, localized data and detailed research focusing on the agricultural response of Rosoman Municipality to climate change is currently scarce. The absence of research dedicated to this region points to the use of broader regional data and generalized observations, supplemented by recent climate data from 2018 to 2022.

### Rosoman's Agricultural Fabric:

In the region of Rosoman municipality, depending on the climatic factors, different agricultural practices are present. Orchards, vineyards and extensive farmland are an integral part of Rosoman's socio-economic identity. The mix of continental and Mediterranean climates, evidenced by warm summers and mild winters, together with adequate sunlight and variable rainfall, have traditionally supported productive agricultural activities, especially in viticulture and fruit growing. However, recent climate data indicating temperature extremes and changing precipitation conditions raise questions about their impact on these already established agricultural practices.

### Climate Change: Local and Global Context:

While climate change is a global phenomenon, characterized by unpredictable temperature shifts, altered precipitation patterns and increased extreme weather events, its local manifestations in areas like Rosoman can have different implications. Recent data showing a record maximum temperature of 42.2°C and a minimum of -10.8°C, together with significant variability in annual precipitation, suggest that Rosoman may be facing unique challenges in the broader scope of global climate change.

### Research Gap and directions:

This lack of specific research on Rosoman agricultural response to climate change highlights a critical gap of relevant data. While broader regional data provide some context, a focused study of Rosoman, taking into account recent climate trends, is essential. Such localized research can offer insights specific to Rosoman's unique agricultural and climatic conditions. This information is critical for farmers, policy makers and stakeholders as it will guide the development of targeted adaptation and mitigation strategies in the face of these environmental changes.

While hypotheses about potential impacts can be drawn from broader trends, the need for dedicated, localized research in this area is increasingly urgent. As climate change continues to reshape global agricultural practices, understanding its effects on specific regions like Rosoman is becoming vital to maintaining current prosperity and ensuring future resilience to climate change.



## Addressing the Research Gap in Rosoman Municipality: The Imperative for Initial Social Impact Assessment

The pronounced research gap regarding agricultural responses to climate change in Rosoman Municipality has practical implications for the community at large. This research gap points to an urgent need for initial social impact assessment. Such an assessment is of crucial importance for delineating and managing the social consequences that climate change has on agriculture at the municipal level, caused intentionally and unintentionally.

Without targeted research specific to Rosoman, generalizations based on broader regional or national data become the norm. Generalized research can provide a preliminary understanding, but lacks the precision and specificity needed to address the specific socio-agricultural challenges of the Rosoman municipality. As climate change reshapes agriculture, its social repercussions extend beyond crop yields. Climate change also affects employment patterns, community dynamics, economic stability, and even cultural practices related to agriculture.

The implementation of an initial social impact assessment aims to:

- **Detailed Understanding:** Acquiring a real understanding of how climate change impacts the agricultural community of Rosoman. This involves recognizing shifts in agricultural practices, understanding changes in crop yields, and discerning alterations in the economic value of agricultural goods.
- **Identifying Vulnerable Groups:** Determining which sections of the municipal population are most vulnerable to these changes. This can include farmers relying on specific crops, seasonal agricultural workers, or even entire communities centered around agrarian practices.
- **Mitigation and Adaptation:** Formulating strategies to mitigate the negative social impacts and leverage potential opportunities. This could involve introducing alternative farming techniques, providing training for new agricultural practices, or even exploring alternative employment opportunities within the agrarian sector.
- **Community Engagement:** Ensuring that the local community is actively involved in the assessment process. Their firsthand experiences, insights, and concerns will be invaluable in painting an accurate picture of the social impacts.

Tangible progress in understanding the nuances of the impact of climate change on agriculture in Rosoman underscores the urgency of the Initial Social Impact Assessment of Climate Change. Such an initiative will not only shed light on immediate challenges, but also provide guidance for future actions, ensuring that the farming community in Rosoman becomes adaptable to global climate challenges.



## Questionnaire Findings

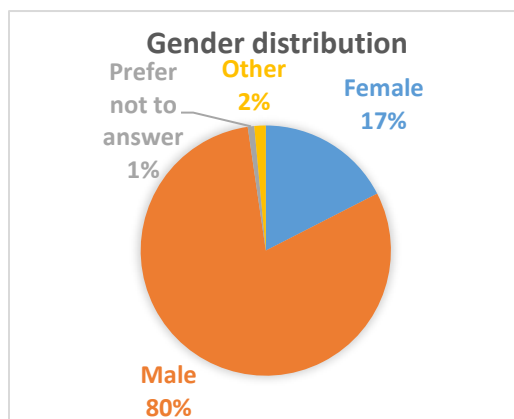
### Demographics

Understanding the demographics of a community plays an instrumental role in interpreting survey results, ensuring that the findings are contextualized and relevant. In our endeavor to gain deeper insights into the perspectives and needs of the residents of Rosoman Municipality, a comprehensive survey comprising 950 questionnaires was conducted. This section provides an overview of the demographic composition of the respondents, offering a foundational context to interpret the subsequent data and analyses. Through this demographic lens, it is ensured that the respondents included in the research are representative of the diverse population of the municipality of Rosoman. This instrument enables informed decision-making and targeted interventions.

### Gender Demographics of the Rosoman Questionnaire Survey:

In the comprehensive survey of 950 respondents from Rosoman Municipality, the gender distribution was as follows:

- **Male:** Out of the total respondents, a significant majority, 762 individuals, identified as male, accounting for approximately 80.2% of the total survey participants.
- **Female:** 166 respondents identified as female, representing roughly 17.5% of the total.
- **Other:** A smaller subset, 14 participants or about 1.5% of the respondents, identified with a gender category outside the conventional male and female labels.
- **Prefer Not to Answer:** A total of 8 participants, making up close to 0.8% of the respondents, chose not to disclose their gender.



This gender distribution provides a clear picture of the respondents' diversity and will be instrumental in ensuring that the survey results are interpreted with an understanding of the predominant male representation, alongside the other gender categories.

The data from the questionnaire on the gender of the population of the municipality of Rosoman point to the following conclusions:

- **Predominant Male Representation:** With 80.2% of respondents identifying as male, there's a clear male majority in this sample. Such a high proportion suggests that the majority of feedback, perspectives, and opinions collected from this survey primarily represent the male demographic of Rosoman.
- **Underrepresentation of Females:** At only 17.5%, the female representation is relatively low. This raises questions about the outreach of the survey or the participation rate among women. There might be various reasons, cultural or logistical, which could have led to this discrepancy. It's crucial to recognize that the perspectives and needs of nearly one-fifth of the sample might differ significantly from the male majority.



## Age Demographics of the Rosoman Questionnaire Survey

Age Range	Number of Respondents	Percentage of Total
18-24	40	4.2%
25-29	463	48.7%
30-34	115	12.1%
35-39	86	9.1%
40-44	64	6.7%
45-49	56	5.9%
50-54	40	4.2%
55-59	35	3.7%
60-64	18	1.9%
65-69	16	1.7%
70-74	7	0.7%
75 & above	10	1.1%
<b>Total</b>	<b>950</b>	<b>100%</b>

The survey is predominantly represented by individuals in their late twenties, followed by those in their early to mid-thirties. The data indicates a younger demographic being the most active or most affected by the survey's topic. On the other hand, older demographics (60 and above) are less represented, possibly indicating lesser active involvement in agricultural activities or reduced engagement with such surveys.

- **Youth (18-24 years):**

Represent a small portion, constituting only 4.2% of the total respondents.

This group is at the beginning of their careers, mostly now entering the agricultural sector or studying.

- **Young Adults (25-29 years):**

The most represented age group, making up a significant 48.7% of the total respondents.

This suggests a major presence of individuals in their late twenties, indicating that this age group might be the most active or most affected by the issues discussed in the survey.

- **Mid Adults (30-44 years):**

This group make up about 28.6% of the respondents.



These individuals are likely to be well-established in their farming careers and might have significant experience and insights into the effects of climate change on agriculture.

- **Late Adults (45-59 years):**

This group represents 13.8% of the sample.

These individuals are nearing or are in the later stages of their careers. Their long-term experience can provide valuable historical context on the changes in agricultural practices and climate impacts over the years.

- **Seniors (60 & above):**

This group represents 3.5% of the respondents.

Representation of the elderly in agriculture, even in this research, is lower. Their perspective, though, is crucial as they can provide insights spanning several decades.

- **Largest Age Group:**

The 25-29 age group dominates the sample, which might indicate a particular interest or stake in the subject of the survey from individuals in this age bracket.

- **Smallest Age Group:**

The 70-74 age range has the least representation at just 0.7%, which might be due to reduced agricultural activity or lesser engagement with surveys in this age group.

The survey is heavily dominated by the 25-29 age group, suggesting that the issues addressed in the survey might be of particular relevance or interest to those in their late twenties.

As age increases, there is a general trend of decreasing participation until the 70-74 age bracket. This could indicate that older generations might either be less involved in the agricultural sector due to retirement or less inclined to participate in such surveys.

The 18-24 age bracket, representing the youth, has a relatively low participation. This might point towards a potential lack of interest or engagement among the youngest age bracket in agricultural matters or the topic of the survey.

Though the senior age brackets (60 & above) have lower representation, their long-term experience in the sector can offer a wealth of knowledge and historical context, which can be invaluable for understanding long-term trends or changes.

The consistent representation of middle-aged groups (30-59 years) indicates a sustained interest and involvement in agricultural activities and issues across these age groups. Their experiences can bridge the gap between the insights of the younger generation and the historical context provided by the seniors.



## Profession Demographics of the Rosoman Questionnaire Survey

- **Farmers:**

They constitute the largest group, making up 44.5% of the total respondents.

This dominance suggests that the majority of those surveyed are directly involved in agricultural practices, making their insights fundamental to understanding ground-level realities and challenges.

- **Agricultural Professionals:**

Representing 41.8% of the respondents, this group almost matches the farmers in number.

These are likely individuals involved in the technical, research, or extension services side of agriculture. Their perspective would be valuable in understanding the scientific, technical, and market trends impacting agriculture.

- **Environmental Professionals:**

Making up 11.2% of the respondents.

This group would provide insights into the environmental challenges, conservation practices, and sustainable farming methods. Their expertise would be crucial in linking agricultural practices with broader environmental concerns.

- **Policy Makers:**

With a representation of just 1.9%, they are among the least represented in the survey.

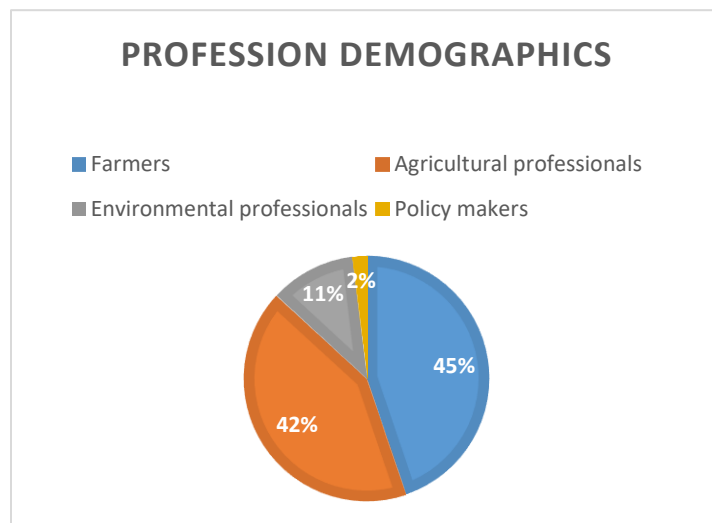
Though small in number, this group's insights are vital, as they would be instrumental in shaping local agricultural policies and regulations.

- **Other:**

A very small fraction, constituting only 0.6% of the respondents.

This category might include stakeholders who don't fit into the predefined categories but have a stake or interest in the agricultural sector of Rosoman.

Ground-Level Representation:





The survey predominantly captures the perspectives of those directly involved in agriculture, with farmers and agricultural professionals together making up a whopping 86.3% of the respondents.

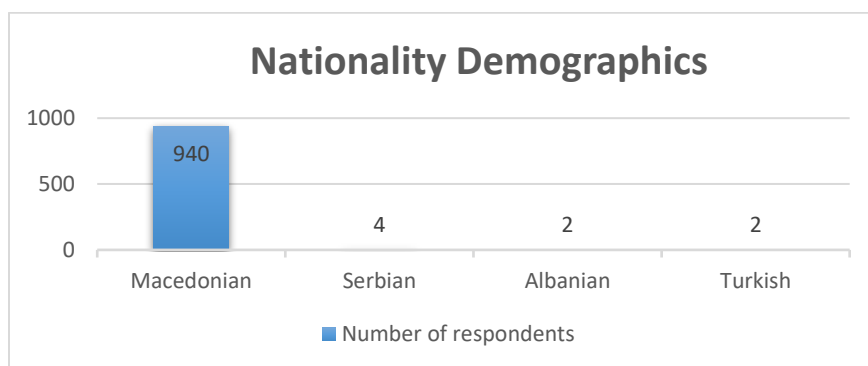
Environmental Concerns:

The presence of environmental professionals indicates that there's a notable emphasis on understanding the environmental implications of agricultural practices.

## Nationality Demographics of the Rosoman Questionnaire Survey

In the Questionnaire Survey, the nationality of respondents was one of the demographics explored. The results provide a keen insight into the representation of different nationalities among the survey participants.

The majority of respondents, a massive 98.9%, identified as Macedonian. This dominance in the survey reflects that the primary target audience or the predominant group engaged in the topics of the survey within Rosoman is of Macedonian nationality.



Other nationalities, including Serbian, Albanian, Turkish, and Greek, have a very minimal representation, with each constituting just 0.2% to 0.4% of the total respondents.

Despite the overwhelming Macedonian majority, the presence of respondents from other nationalities, albeit in small numbers, showcases the diversity in the Rosoman region. This diverse representation, even if minimal, hints at the multicultural fabric of Rosoman and the surrounding areas.

The nationality demographics of the Rosoman Questionnaire Survey paints a clear picture of a predominantly Macedonian participant base. While the representation from other nationalities is minimal, their inclusion offers a hint of the diverse tapestry of nationalities in Rosoman.



## Migration in Municipality of Rosoman

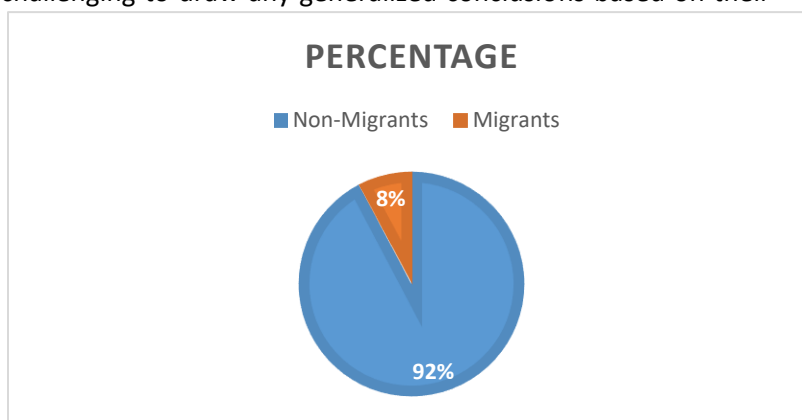
In the Questionnaire Survey, the aspect of migration was explored to understand the composition of residents who have migrated to North Macedonia from other countries.

The vast majority of respondents, 92.3%, indicated that they did not migrate to North Macedonia from another country. This suggests that a significant portion of the survey's participants are likely native to North Macedonia or have been residing there for an extended period.

Only 7.7% of the respondents indicated that they had migrated to North Macedonia from another country. This relatively small percentage highlights the limited migrant population in the Rosoman region or their limited participation in the survey.

Among the migrants, the origins are diverse, albeit represented in very small numbers. Specifically, only two countries of origin were mentioned: Serbia and Germany. Each of these countries has one representative in the survey, making it challenging to draw any generalized conclusions based on their responses.

The minimal migrant representation in the survey suggests that the primary concerns, perspectives, and experiences captured are predominantly from individuals who did not migrate to North Macedonia. While the insights from the migrants are valuable, they represent individual experiences rather than broader trends.



The migration dynamics revealed by the Questionnaire Survey showcase a predominant non-migrant population with a very limited number of migrants. The diverse origins of these migrants, even if represented minimally, indicate a varied tapestry of backgrounds in the region.





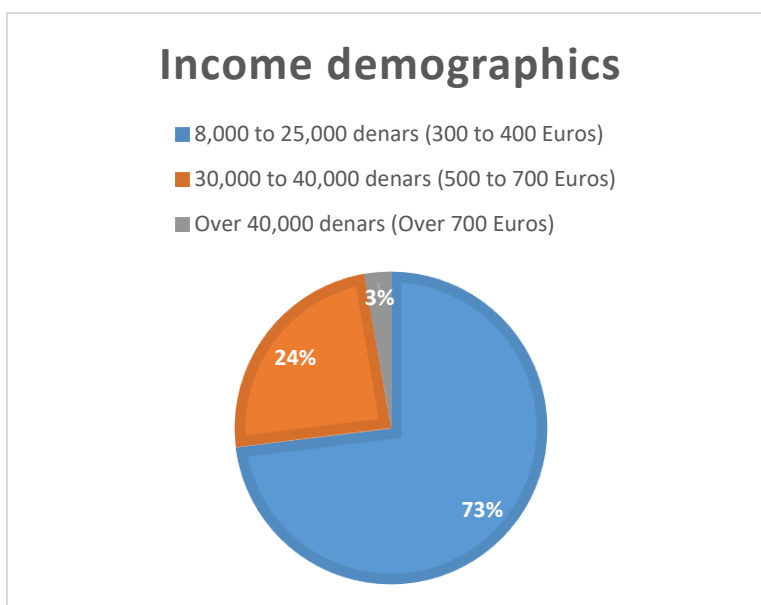
## Income Demographics

The Questionnaire Survey delved into the income levels of respondents to understand the economic landscape of the region and the financial capacities of its residents.

A significant portion of the respondents, 73%, fall within the monthly income range of 18,000 to 25,000 denars (equivalent to 300 to 400 Euros). This suggests that a large majority of the survey participants have a monthly income that can be considered on the lower side of the spectrum.

Approximately 24.2% of respondents have an income ranging from 30,000 to 40,000 denars (500 to 700 Euros montly). This group represents the middle-income bracket among the survey participants, suggesting a moderate but substantial portion of residents with a slightly higher financial capacity.

Only a small fraction, about 2.7%, reported earning over 40,000 denars (more than 700 Euros montly). This limited representation indicates that high-income earners are not predominant in the Rosoman region or might not have been as actively involved in the survey.



The predominant lower income bracket suggests that affordability and cost of living might be significant concerns for many residents. Economic policies or initiatives targeting this demographic would need to be sensitive to these financial constraints.

The limited high-income earners in the survey might indicate either a smaller population of this demographic in Rosoman or potentially different channels of engagement or interest for this group.

The income demographics from the Rosoman Questionnaire Survey paint a picture of a region where a majority of residents fall within the lower to middle-income brackets. This information is crucial for understanding the economic challenges and opportunities in the region. It offers information into the financial capacities of residents, which can guide policy-making, economic initiatives, and targeted outreach efforts.



## Education Demographics in Rosoman

The survey analyzed the level of education in the region of Rosoman municipality.

A significant 48.8% of respondents have completed secondary education. This suggests that nearly half of the surveyed population in Rosoman have attained an education level equivalent to high school.

30.4% of the respondents have primary education. This group represents individuals who might have completed their schooling up to the elementary school levels.

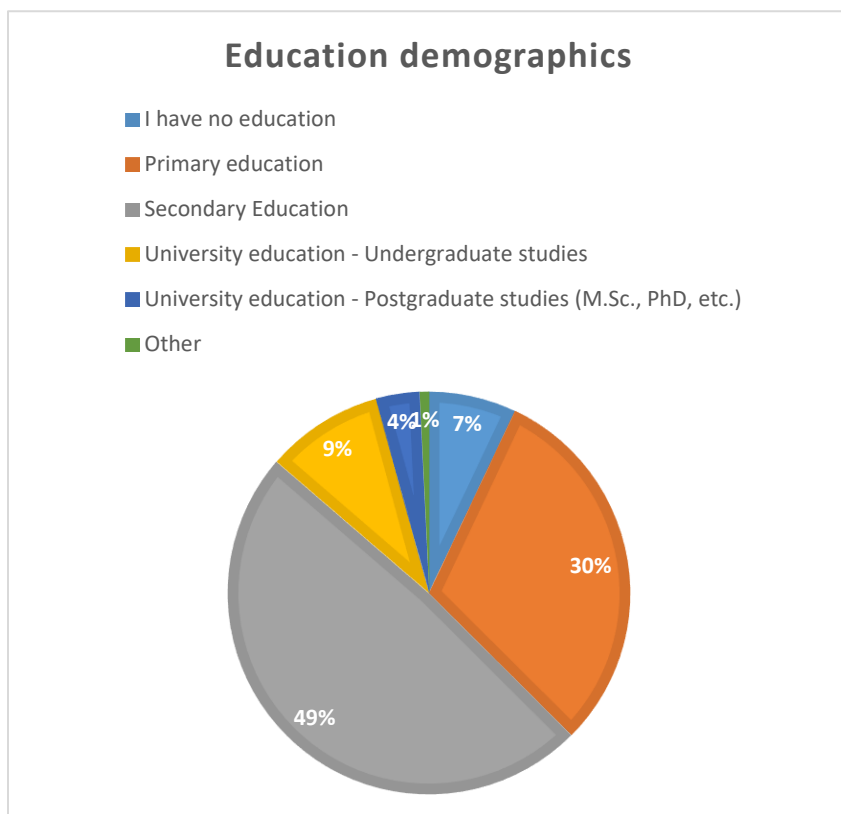
9.5% of the survey participants have completed undergraduate university studies. This group has pursued higher education at the bachelor's level.

Only a small fraction, about 3.5%, have pursued postgraduate studies, such as Master's or Ph.D. programs. This suggests that advanced academic pursuits are relatively less common among the survey participants.

7.1% of respondents indicated having no formal education. This segment highlights the existence of an under-educated or non-educated population in the region, which might have implications for employment opportunities, economic mobility, and access to resources.

A minimal 0.7% of the respondents fall under the "Other" category. This might include non-traditional education paths, vocational training, or other forms of non-standard educational experiences.

The education demographics from the Rosoman Questionnaire Survey provide insights into the academic achievements of the region's residents. With a substantial portion of the respondents having secondary education and a smaller but notable group with university degrees, the region showcases a varied educational landscape. Understanding this analysis of the level of education is crucial for devising educational policies, training programs, and economic initiatives tailored to the unique needs and capacities of the Rosoman populace.





## Perception of Climate Change

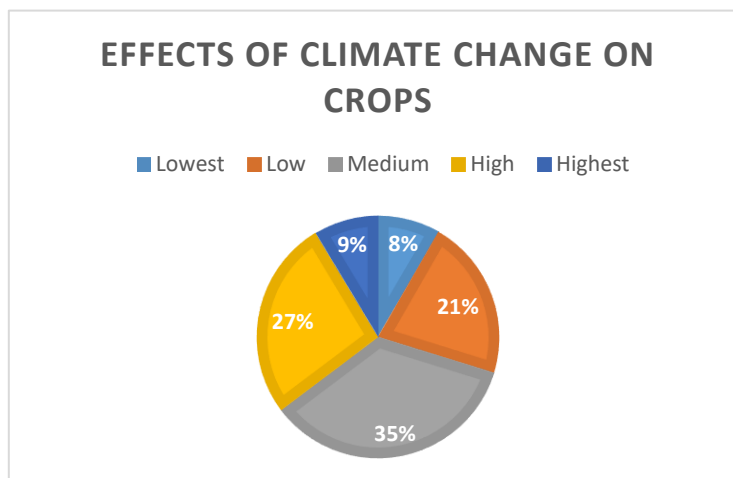
The columns relating to "Perception of Climate Change" cover various aspects, including the impact on crops, ranking the causes of damage due to climate change, its effect on population migration, personal knowledge about its effects, awareness of helpful products/resources in agriculture, knowledge of agricultural technologies to mitigate negative impacts, the role of education in coping with climate-related disasters, and the adequacy of education on local farming practices' adaptation to climate change.

### Effects of Climate Change on Crops

The perceptions of respondents regarding the effects of climate change on crops is crucial to understand how aware and concerned they are about the potential impacts on agricultural productivity.

The respondents were asked to rate the effects of climate change on crops, with ratings ranging from 1 (lowest) to 5 (highest).

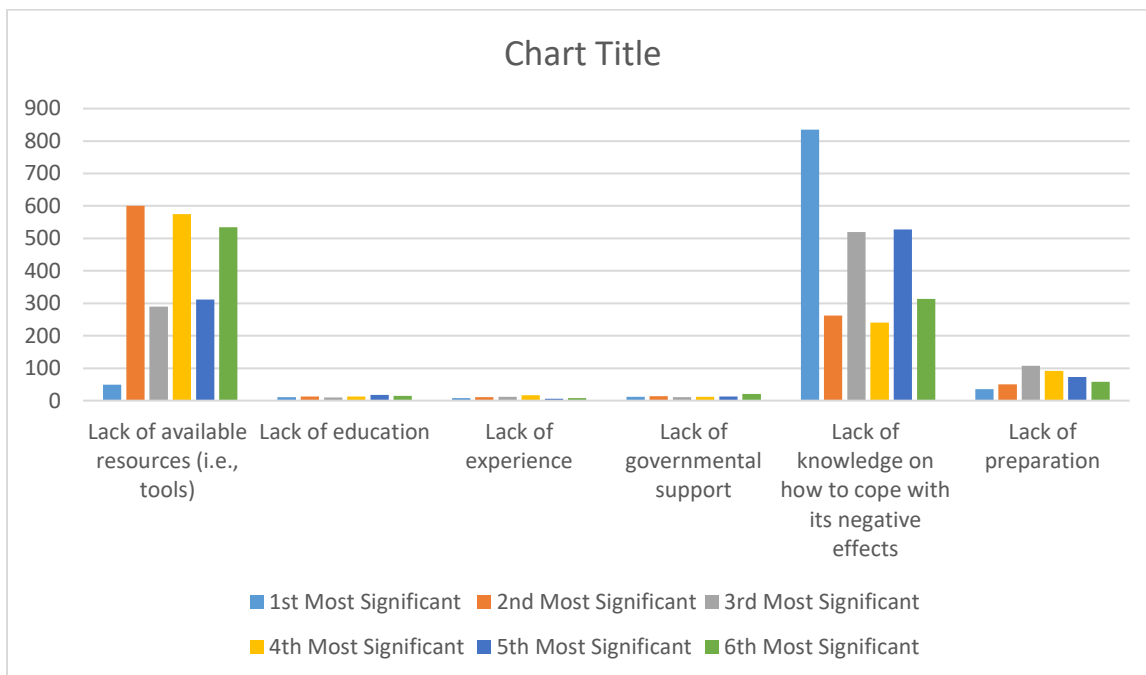
From these results, it's evident that a majority of respondents perceive moderate to high effects of climate change on crops, with the most common rating being 3, followed by the ratings 4 (27%) and 2 (21%). This suggests that there's a considerable awareness among respondents about the tangible impacts of climate change on agricultural productivity.





## Underlying Reasons for the Damage Caused by Climate Change

The study on "Underlying Reasons for the Damage Caused by Climate Change" sought to understand the perceptions regarding the primary factors contributing to climate change-induced damage in agriculture. Respondents rated the significance of different reasons, providing insights into what is considered most impactful. Here's a detailed breakdown of these reasons according to the frequency they were chosen for each rank:



**First Most Significant Reason:** The predominant reason identified was the "Lack of knowledge on how to cope with its negative effects." A large number of respondents (835) placed this at the top, highlighting a critical gap in understanding effective responses to climate change in agriculture.

**Second Most Significant Reason:** The "Lack of available resources (i.e., tools)" emerged as the second most significant factor, with 600 respondents ranking it here. This suggests that resource constraints are seen as a major barrier in combating the effects of climate change in agriculture.

**Subsequent Rankings:** The other ranks also shed light on various factors such as "Lack of education," "Lack of experience," "Lack of governmental support," and "Lack of preparation." The distribution of responses across these ranks indicates a broad recognition of multiple interconnected issues contributing to climate change-related damage in agriculture.

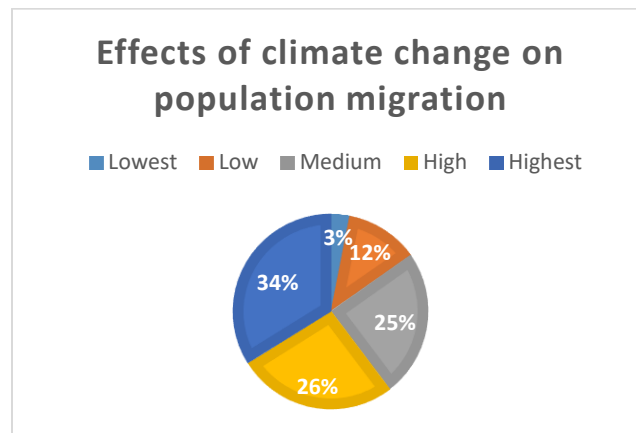
*These findings collectively underscore a perception among respondents that a combination of knowledge deficits, resource limitations, educational gaps, and insufficient support structures are the main challenges in addressing the damages caused by climate change in the agricultural sector. This highlights the need for multifaceted approaches to enhance resilience and adaptive capacity towards the climate change.*



### Effects of Climate Change on Population Migration:

Respondents were asked to rate the effects of climate change on population migration, with ratings ranging from 1 (lowest) to 5 (highest). Here are the results:

The findings reveal that a significant portion of respondents perceive a high to very high impact of climate change on population migration (with ratings 4 and 5 being the most frequent). This perception suggests that many individuals believe climate change could potentially drive people to migrate from areas that are more affected by the negative impact of climate change.





## Impact on Agricultural Practices

To comprehend the influence of climate change on agricultural methods in Rosoman, we examined respondents' perceptions of specific impacts. This analysis aims to pinpoint the obstacles encountered by farmers and agricultural experts, shedding light on areas requiring immediate attention and adaptation strategies.

## Awareness About Potential Products/Resources

Understanding the level of awareness about potential products/resources that can mitigate the effects of climate change is crucial. It provides insights into whether the agricultural community is informed about the tools and resources available to them.

When asked about their awareness of potential products or resources that can help combat the negative effects of climate change on their agricultural practices:



613 respondents (64.5% of the total) indicated they are not aware.

250 respondents (26.3% of the total) said they are aware.

87 respondents (9.2% of the total) indicated the option "Not Available".

It's evident that a significant majority of respondents are not informed about potential products or resources that could assist them in mitigating the adverse effects of climate change on agriculture. This lack of awareness can hinder

effective adaptation and resilience-building in the face of changing climate patterns.

## Usage of Products/Resources in Agricultural Practices

Following the assessment of awareness levels, it is crucial to delve into the actual usage of these identified products or resources by those who are aware of them. This examination will provide insights into the practical implementation and adoption rates of these climate change mitigation tools in agricultural practices.



**Non-Users:** A significant portion, 484 respondents or 50.9% of the total, indicated they do not employ these potential products or resources in their agricultural practices.



**Users:** Conversely, 282 respondents, representing 29.7% of the total, affirmed their use of these products or resources.

Option "Not Available": This choice was selected by 151 participants, constituting 15.9% of the total.

*These findings indicate a notable gap between awareness and actual usage of climate change mitigation tools in agriculture. The relatively lower usage rate, despite a certain level of awareness, suggests barriers to adoption or implementation of these resources in the agricultural practices of Rosoman. Understanding and addressing these barriers could be key to enhancing climate resilience in the region's agriculture.*

## Specific Products Used and Their Implementation

To get a comprehensive view of the impact on agricultural practices, it's also beneficial to know which specific products or resources are being used by respondents and how they're integrating them into their practices. This provides insights into the preferred solutions and their practical applications. Let's explore the responses related to this aspect.

### Specific Products Used and Their Implementation:

Upon examining the responses about the specific products being used and their implementation methods, it appears there's an inconsistency in the dataset.

This suggests either an oversight during the data collection process or that most respondents chose not to provide specific details about the products they use.



## Social Impact

The social ramifications of climate change are multifaceted. They touch upon various dimensions of life, from health and livelihoods to demographic factors like age and gender. Here, we will delve into the perceptions of the respondents from Rosoman to understand how they perceive the social impacts of climate change.

### Impact by Age

To determine if the age of farmers influences their vulnerability to climate-sensitive disasters, we analyzed respondents' perceptions. This understanding is crucial for identifying age groups that may need more focused support and intervention.

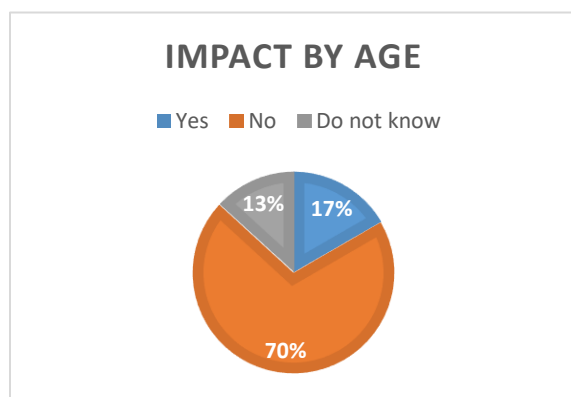
#### Variability by Age

The survey questioned participants on whether they believe the impact of climate-sensitive disasters varies with the farmer's age.

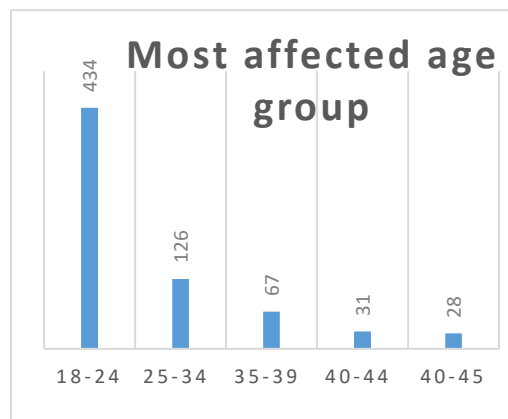
**No Perceived Age Impact:** A significant majority, 667 respondents or 70.2% of the total, indicated they do not believe that the impact varies with age.

**Yes to Age Impact:** On the other hand, 158 respondents, which is 16.6% of the total, did believe that age affects the impact of these disasters.

**Uncertain About Age Impact:** Additionally, 125 respondents, or 13.2% of the total, chose "Don't know" as their response.



This data suggests that most participants do not perceive age as a significant factor in how climate-sensitive disasters affect farmers. However, the acknowledgment by a noteworthy minority that age could play a role highlights the need for further exploration into this aspect. Specifically, it is important to identify which age groups are perceived as more vulnerable and understand the reasons behind this perception.



#### Most Affected Age Group

The survey further explored which age groups are perceived to be most negatively impacted by climate changes. Understanding this aspect can guide targeted support and interventions for these groups.

Respondents were asked to identify the age range they believe faces the most negative consequences due to climate changes:





- 18-24 Years Old Group: The majority, 434 respondents, believe that farmers in the 18-24 age group are the most affected.
- 25-34 Years Old Group: 126 respondents pointed towards the 25-34 years old group as the most vulnerable.
- 35-39 Years Old Group: 67 respondents felt that the 35-39 age group faces significant negative impacts.
- 40-44 Years Old Group: A smaller number, 31 respondents, identified the 40-44 years old group as adversely affected.
- 45-49 Years Old Group: 28 respondents indicated that the 45-49 years old group is notably impacted.

While there were various other age combinations and specific groups mentioned, these top five represent the most frequently perceived as vulnerable. The data prominently suggests that younger farmers, particularly those between 18-24 years old, are perceived to be more susceptible to the adverse impacts of climate changes. This perception could stem from factors such as lack of experience, limited resources, or other unique challenges faced by younger farmers, underscoring the need for targeted support and resources for this demographic..





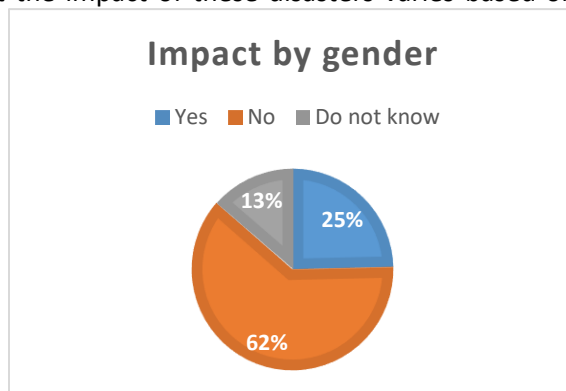
## Impact by Gender

The survey aimed to gauge perceptions regarding whether the gender of a farmer influences their experience with the negative impact of climate change. This understanding is crucial for identifying potential gender-specific vulnerabilities and the need for tailored support strategies.

### Variability by Gender

Respondents were queried about their views on whether the impact of climate-sensitive disasters varies with the farmer's gender.

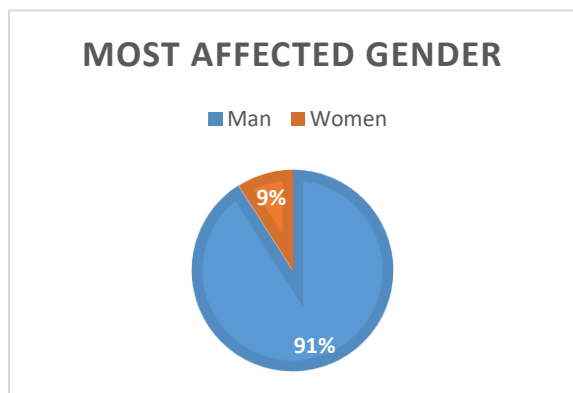
- **No Gender-based Impact Perceived:** The majority of the participants, 587 respondents or 61.8% of the total, indicated they do not believe that the impact of these disasters varies based on gender.
- **Yes to Gender-based Impact:** A notable portion, 234 respondents (24.6% of the total), affirmed a belief in a gender-specific impact.
- **Uncertainty About Gender Impact:** 129 respondents, representing 13.6% of the total, chose "Don't know" as their response.



These findings reveal that while most participants do not view gender as a significant factor in how farmers are affected by the negative impact of climate change, there is still a considerable number of respondents who do perceive a difference based on gender. It is crucial to delve deeper into these perceptions to understand which gender is thought to be more adversely affected and why. This could highlight gender-specific challenges in the agricultural sector and inform the development of more inclusive and effective climate resilience strategies.

### Most Affected Gender

The survey sought to understand respondents' views on which gender faces the most negative consequences from climate-sensitive disasters. This perception is essential for recognizing potential gender-specific impacts and tailoring appropriate support and intervention strategies.



Participants were asked to identify which gender they believe is more adversely affected by climate-sensitive disasters.

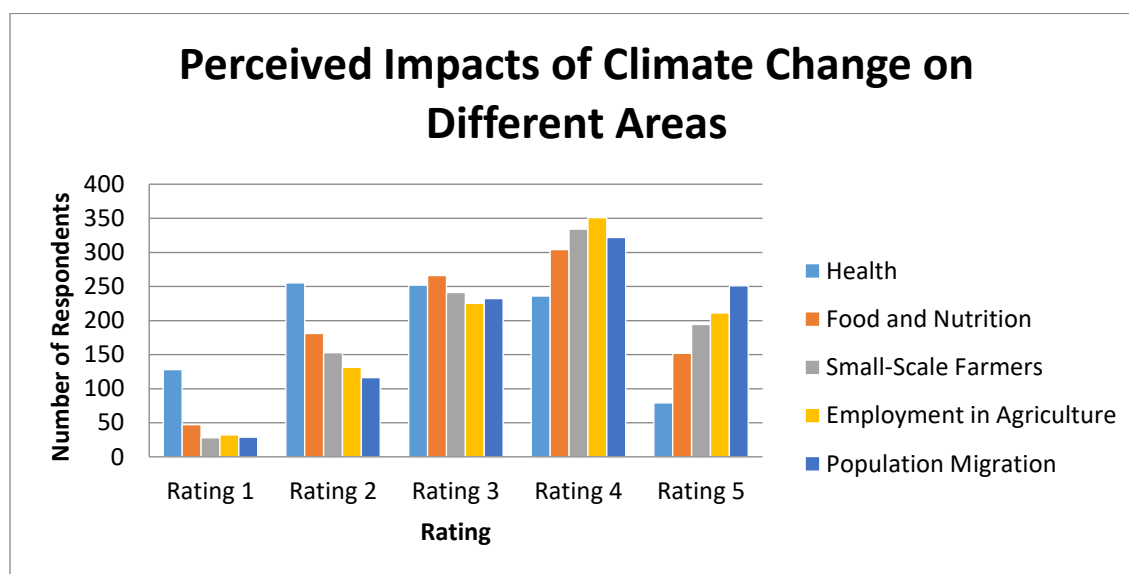
**Men are More Affected:** A significant majority, 805 respondents, perceive men to be more vulnerable to the impacts of these disasters, while only 80 respondents think that women face more severe consequences.



The predominant perception that men are more vulnerable could be rooted in traditional societal roles. In many communities, men are often more engaged in outdoor agricultural activities, potentially placing them at greater direct risk from the varied impacts of climate change. This insight not only points to perceived gender differences in experiencing the negative impact of climate change, but also emphasizes the need for gender-specific support and adaptation measures in the agricultural sector. Addressing these perceptions and the realities they may reflect can help in developing more inclusive and effective strategies for building resilience against climate change impacts in agriculture.

## Impacts on Health, Nutrition, Small-Scale Farmers, Employment, and Migration

The enclosed clustered column chart provides a visual representation of the survey results regarding the perceived impacts of climate change across five distinct areas: Health, Food and Nutrition, Small-Scale Farmers, Employment in Agriculture, and Population Migration. Each cluster of columns corresponds to one of these areas and is further divided into five columns representing the impact ratings given by respondents, from 1 (least impact) to 5 (most impact).



### Key Findings:

**Health:** Respondents generally perceived a moderate impact of climate change on health, with the majority providing ratings in the mid-range (2, 3, and 4).

**Food and Nutrition:** Concerns regarding the impact of climate change on food security and quality are evident, as a significant number of respondents rated the impact as high to very high (ratings 4 and 5).

**Small-Scale Farmers:** The data indicates a perception of high vulnerability among small-scale farmers, with a substantial proportion of ratings clustering at 4, suggesting that climate change is expected to have a considerable impact on this group.



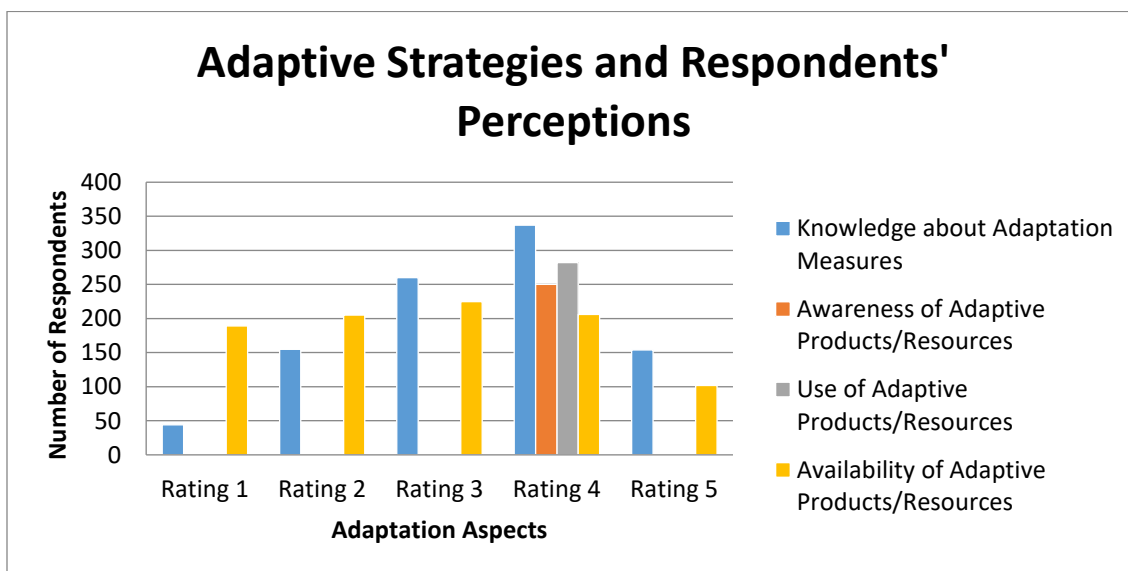
**Employment in Agriculture:** There is a clear concern about the potential of climate change to disrupt employment in the agricultural sector, with the majority of respondents indicating a high level of impact (ratings 4 and 5).

**Population Migration:** The survey results suggest that climate change is seen as a likely driver for population migration, with high numbers of respondents indicating that the impacts could lead to significant population movements (ratings 4 and 5).

**Implications:**

The findings underscore the need for targeted interventions to mitigate the impacts of climate change, particularly in supporting small-scale farmers and securing agricultural employment. The data also highlights the urgency of addressing potential increases in population migration due to the negative impact of climate change. Policymakers and stakeholders are encouraged to consider these perceptions in their planning and response strategies to build resilience against the multifaceted challenges posed by climate change.

**Adaptive Strategies**



The accompanying column in the chart illustrates the survey respondents' perceptions of various adaptive strategies in the context of climate change. This includes their self-assessed knowledge of adaptation measures, awareness and usage of adaptive products/resources, and the availability of such resources in their region. Each column within the clusters reflects the number of respondents aligned with each rating level, from 1 (indicating the least) to 5 (indicating the most).

**Key Findings:**



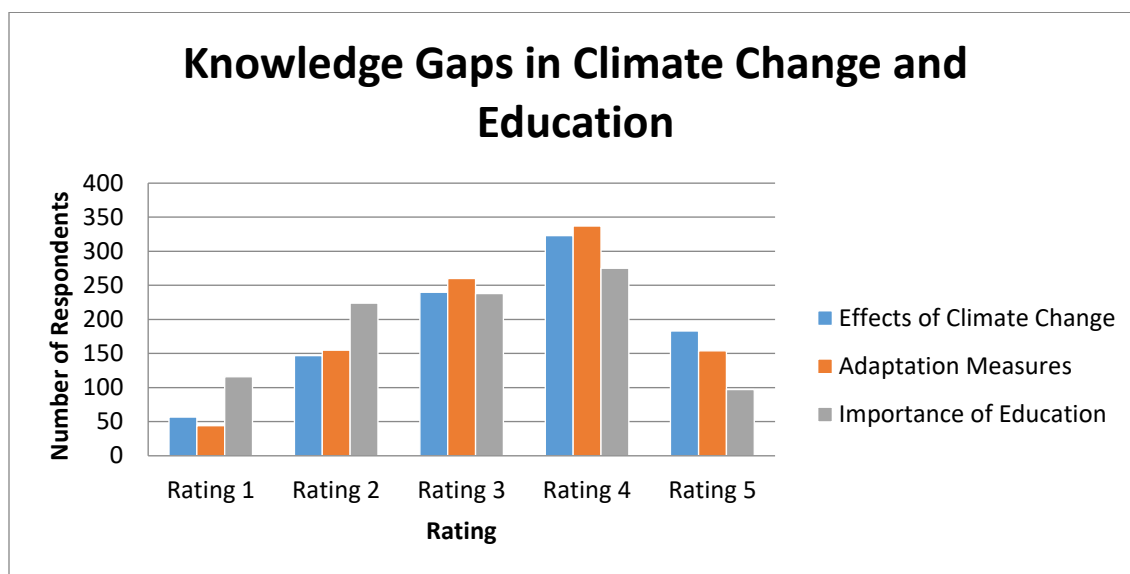
- **Knowledge about Adaptation Measures:** A substantial number of respondents (337) rate their knowledge of adaptation measures highly (rating 4), suggesting a good level of understanding among the community. A notable segment also expresses moderate awareness (rating 3), while a smaller group feels less informed (rating 1 and 2), pointing to a gap that could be addressed through educational outreach.
- **Awareness and Use of Adaptive Products/Resources:** While 250 respondents are aware of adaptive products/resources, fewer (282) report using them. This discrepancy may be attributable to factors such as cost, availability, or a gap in practical knowledge.
- **Availability of Adaptive Products/Resources:** Perceptions of availability are varied, with a significant number considering it to be average (rating 3) or good (rating 4). Yet, nearly as many respondents find availability to be limited (rating 1 and 2), which could signify access barriers that need to be mitigated.

**Implications:** The data reflects an active recognition among the respondents of the importance of adaptive strategies in countering the effects of climate change on agriculture. However, it also indicates substantial room for improvement in disseminating knowledge, enhancing the accessibility of adaptive resources, and ensuring these are utilized effectively. Policymakers are recommended to address these findings by bolstering educational programs, subsidizing the cost of adaptive technologies, and improving the distribution channels to enhance resource availability. By focusing on these areas, strategies can be better tailored to meet local needs and empower communities to adopt more resilient agricultural practices



## Knowledge gaps

The survey conducted to assess the community's understanding and awareness of climate change has unearthed significant insights into the perceived knowledge gaps and the importance of education in adaptation strategies.



### Knowledge about Effects of Climate Change:

The data provide a varied picture of self-assessment regarding the effects of climate change. A majority of participants rate their knowledge as 'Good' (323 respondents) or 'Excellent' (183 respondents), suggesting a considerable level of awareness within the community. However, a significant number of individuals express limited understanding, with 147 respondents acknowledging 'Below average' knowledge and 57 indicating 'Very poor' knowledge. This variation highlights the necessity for targeted educational interventions to elevate the baseline understanding of climate change impacts.

### Knowledge about Adaptation Measures:

In terms of adaptation measures, a parallel trend is observed. A notable group (337 respondents) considers their knowledge to be 'Good', while a smaller yet substantial cohort (154 respondents) rates their understanding as 'Excellent'. Despite this, the presence of 155 individuals who perceive their knowledge as 'Below average' and 44 as 'Very poor' underscores the critical need for disseminating information on practical adaptation strategies.

### Importance of Education in Coping with Climate Change:

The respondents also weighed in on the importance of education in managing climate change effects. The majority (275 respondents) acknowledge education as having 'Good' importance, while a few (97 respondents) view it as 'Very high'. The recognition of education's significance by the community



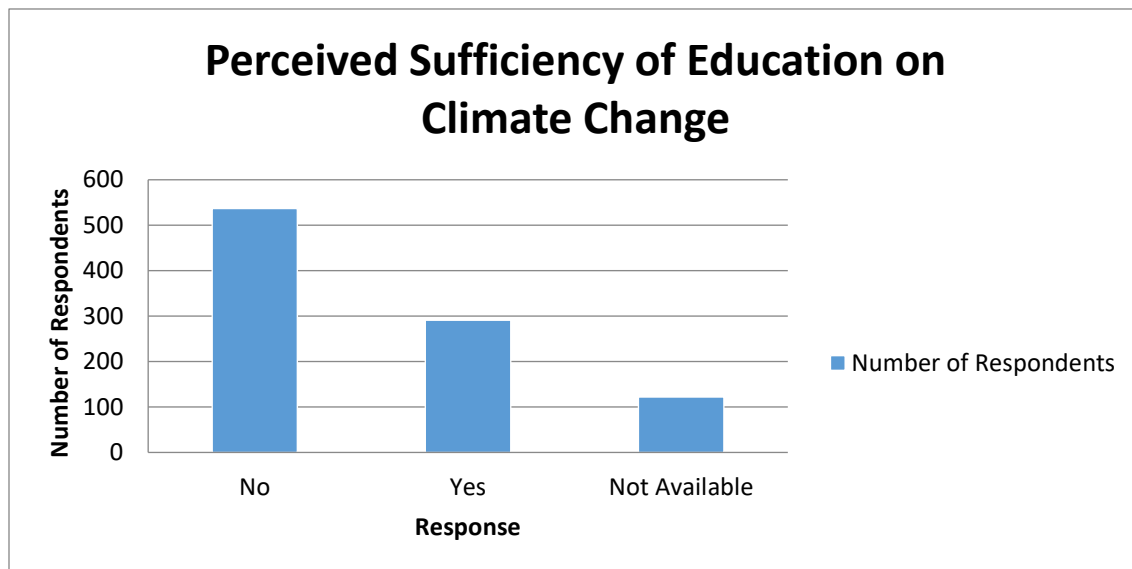
members reflects a collective inclination towards learning as a pivotal tool in combating climate change challenges.

The survey results are indicative of a community that is partially informed but still faces considerable knowledge gaps. While there is a foundation of understanding, it is clear that more extensive and more concrete educational programs are required. Efforts should be concentrated on simplifying complex scientific information into actionable knowledge and on enhancing accessibility to learning resources for all community members.

Policymakers and educators must collaborate to design curriculum and outreach programs that address these gaps. Fostering an environment where continuous learning and adaptation are encouraged could significantly bolster the community's resilience to climate change.

### Sufficiency of Current Education:

This aspect provides insights into whether the respondents feel they have received adequate education regarding the effects of climate change on local farming practices. A pivotal element of our survey aimed to gauge whether the local farming community feels adequately educated about the effects of climate change on their agricultural practices. The responses serve as a indicator for the effectiveness of existing educational resources and strategies in place to deal with this global challenge.



A significant majority of the respondents, amounting to 537 individuals, expressed that the current level of education and information provided to them is insufficient. This sentiment underscores a pressing need for enhanced educational initiatives tailored to the specificities of local farming and the multifaceted impacts of climate change.



On the other hand, 291 respondents believe that the education they have received is sufficient, suggesting that there are segments within the community that are reaching an adequate level of understanding and preparedness.

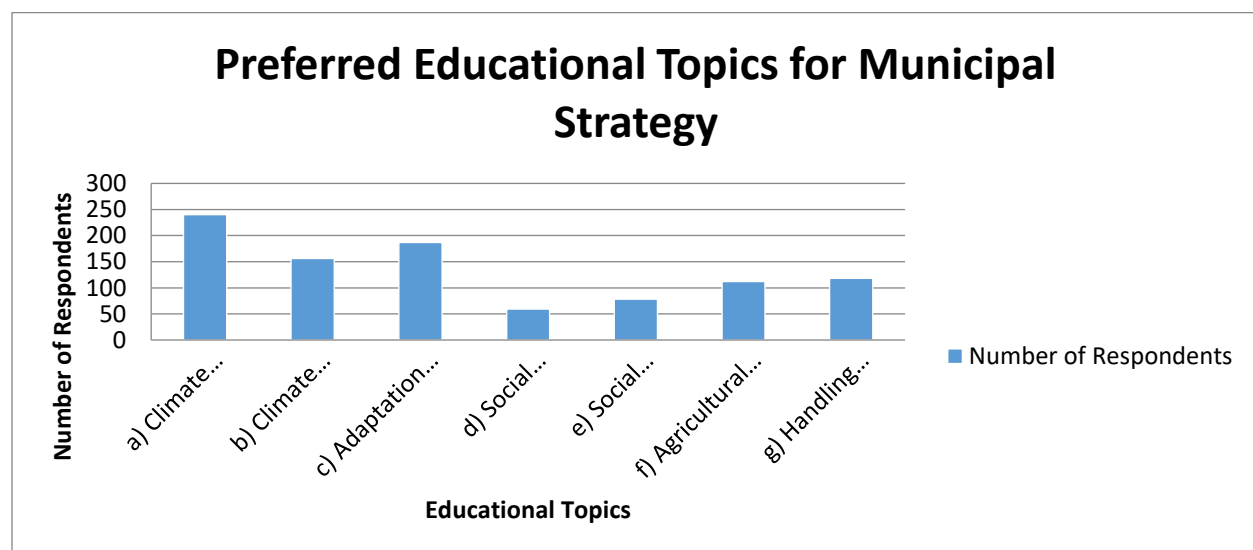
However, there remains a notable portion of the surveyed population, 122 respondents, who did not express a definitive opinion or lacked the knowledge to assess the sufficiency of their education. This group might represent an untapped audience for educational programs or could reflect a segment that is disengaged or disenfranchised from current educational outreach efforts.

The clear indication of a knowledge deficit as reported by the majority of respondents calls for immediate attention from policymakers, educators, and agricultural extension services. It is imperative to develop a structured and sustained educational framework that can bridge the identified gaps. Programs should be designed to be accessible, practical, and relevant, ensuring that farmers are equipped not only with theoretical knowledge but also with actionable guidance to adapt to the changing climate.

Moreover, the findings suggest a potential for improvement in how educational content is communicated and the need to make it more inclusive to capture the attention of the entire farming community, including those who have not yet engaged with agriculture.

### Educational Topics for Municipal Strategy:

Understanding which topics the respondents believe should be emphasized in the Municipal Strategy for Climate Change Adaptation in Rosoman provides insights into areas of focus for educational interventions.



The survey's findings on educational preferences offer a glimpse into the community's priorities regarding the knowledge needed to forge a robust Municipal Strategy for Climate Change Adaptation in Rosoman. The diversity of responses underscores a demand for a integrated educational approach that addresses the varied aspects of climate change.





- **General Climate Change Information:** The majority of respondents (240) identify a need for comprehensive information about climate change, indicating a foundational requirement for broad literacy about the impact of climate change.
- **Local Farming Practices:** Insight into the intersection of climate change with local farming practices is a priority for 156 respondents, suggesting a call for context-specific educational content.
- **Adaptation Measures:** With 187 respondents seeking knowledge on adaptation measures, there is a clear demand for actionable strategies to combat the effects of climate change.
- **Social Drivers and Vulnerabilities:** A smaller segment of the community (59 respondents) points to the social drivers of climate change, such as gender, age, and income level, as critical educational topics.
- **Health, Food, and Farm Size Impacts:** Social impacts on health, food, and nutrition security, and farm sizes gather attention from 78 respondents, reflecting concerns over the broader implications of climate change.
- **Agricultural Technologies:** A significant number of individuals (112) express the need for information on agricultural technologies, highlighting a trend towards modernization and efficiency.
- **Practical Handling of Climate Effects:** Practical tips on handling the effects of climate change are sought after by 118 respondents, emphasizing the need for direct and practical knowledge.

These insights should inform the creation of a tailored educational strategy that prioritizes these topics according to the community's needs. Educational initiatives must ensure that they are not only comprehensive in scope, covering from basic climate change information to the specifics of local farming challenges, but also accessible and actionable, enabling the community to translate knowledge into practice.

The emphasis on a wide range of educational topics reflects a community eager to understand and adapt to the changing climate. As such, a strong educational program becomes not only a tool for knowledge, but also a catalyst for transformation, through which the municipality of Rosoman will contribute to successfully dealing with the challenges posed by climate change.



## Qualitative Findings: Interviews

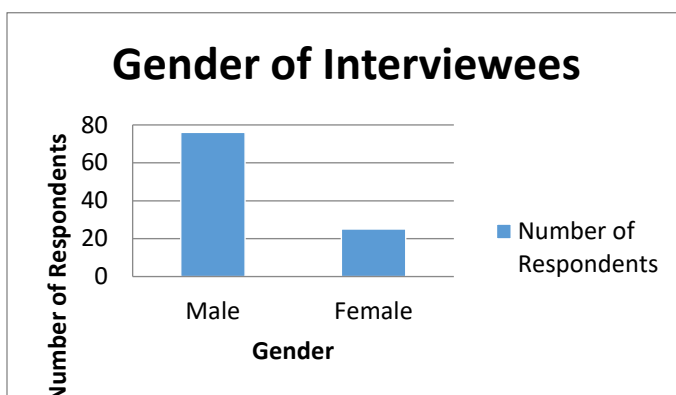
### Demographics

The qualitative interviews provide a getting insights into the lived experiences and perspectives regarding climate change. Here, we present a demographic breakdown of the interviewees, which is based on the diversity and representativeness of the participants in the study.

#### Gender Distribution

**Male Respondents:** Making up 75.2% of the interviewees, with 76 male participants, this group forms the majority, reflecting the gender distribution in the agricultural sector of the region.

**Female Respondents:** With 25 female participants, representing 24.8%, the female perspective is lesser in number but provides essential insights into the unique challenges and views of women in the context of climate change and agriculture.

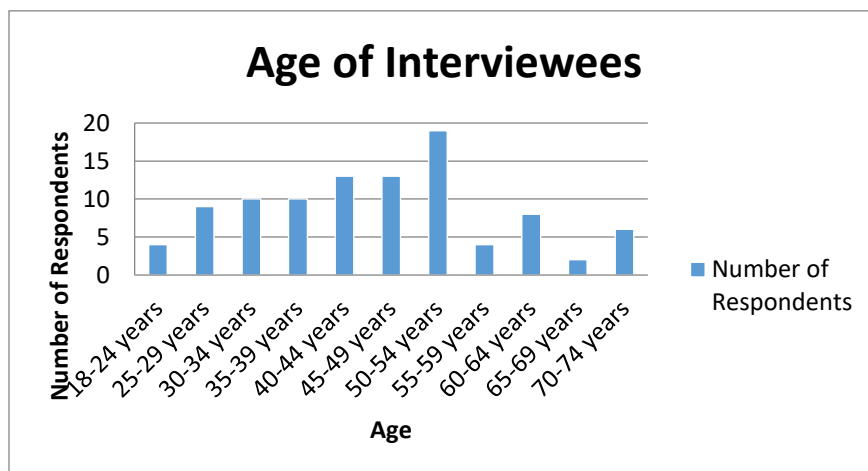


#### Age Distribution:

The age of respondents varies widely, ranging from 19 to 73 years.

Most of the respondents belong to the middle-aged group, which is also the most represented in the agricultural activity.

The age group with the most representation in the sample is 50-54 years, with 19 respondents.

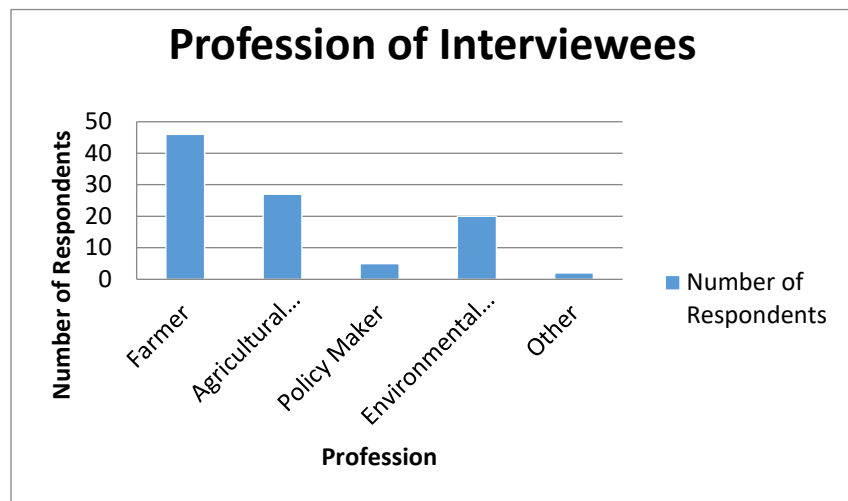
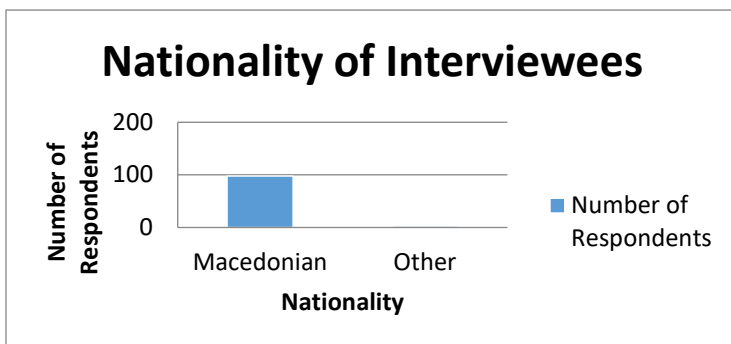




### Nationality Distribution

**Macedonian:** A significant majority of 97.03%, or 98 respondents, identify as Macedonian, underscoring the local context of the study.

**Other Nationalities:** A small minority of about 2.97%, or 3 respondents, adds to the diversity of national backgrounds.



### Profession Distribution:

**Farmer:** Representing a significant chunk, 45.5% or 46 respondents are farmers.

**Agricultural Professional:** This group consists of 26.7% or 27 respondents, indicating a good representation from the agricultural sector.

**Policy Maker:** A smaller group, 4.95% or 5 respondents, are involved in policy-making.

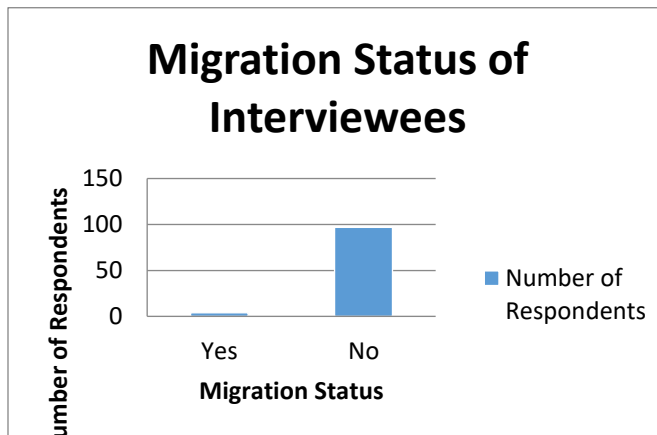
**Environmental Professional:** 19.8% or 20 respondents come from an environmental background, providing a perspective from the conservation and environmental standpoint.

**Other Professions:** Only 2 respondents, making up 1.98%, fall into other professional categories.

### Migration Status:

**Yes:** A tiny portion, 3.96% or 4 respondents, have migrated to North Macedonia from another country.

**No:** The vast majority, 96.04% or 97 respondents, are non-migrants.



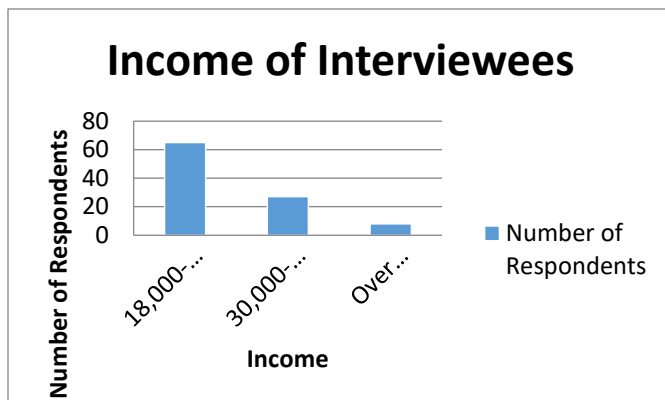


**Income Distribution:**

From 18,000 to 25,000 denars (300 to 400 Euros): 64.36% or 65 respondents fall into this income bracket, indicating that a majority have a lower income.

From 30,000 to 40,000 denars (500 Euros to 700 Euros): Representing 26.7% or 27 respondents, this group has a moderate income.

Over 40,000 denars (Over 700 Euros): A smaller group, 7.92% or 8 respondents, have a higher income.



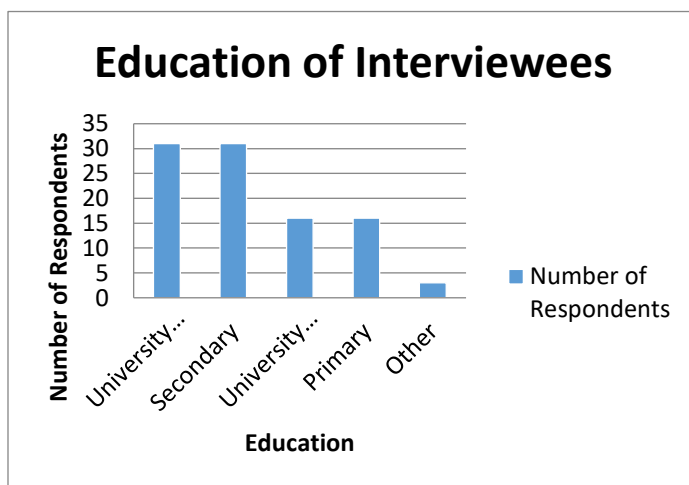
**Education Distribution:**

University Education (Undergraduate studies): This group consists of 30.69% or 31 respondents, indicating that almost one-third of the respondents have at least an undergraduate degree.

Secondary Education: Another large group, 30.69% or 31 respondents, have finished secondary education.

University Education (Postgraduate studies - M.Sc., PhD, etc.): 15.84% or 16 respondents have pursued postgraduate studies, bringing a higher educational perspective to the mix.

Primary Education: 15.84% or 16 respondents have primary education.



Other: 2.97% or 3 respondents fall into other educational categories.

The demographics provide a comprehensive understanding of the interviewees' backgrounds, helping in contextualizing their responses in subsequent sections.



## Stakeholder Opinions

The feedback from stakeholders is invaluable for understanding the broader sentiments, concerns, and perspectives regarding climate change's impact on agriculture. We combined the analysis from the qualitative interviews with the quantitative data, focusing on frequency and patterns, to provide a more holistic insight.

### 1. Impact of Climate-Based Disasters on Farmers:

- Majority of respondents cited “reduced yields and increased unpredictability” as significant outcomes of climate-based disasters. Specifically, 63 individuals mentioned these challenges, emphasizing the increased difficulty of farming in contemporary times.

- “Financial instability” is another major concern, with 28 respondents highlighting the economic challenges posed by unpredictable weather patterns, potentially leading to failure in the cultivation of agricultural crops.

Reduced yields and  
increased  
unpredictability



### 2. Underlying Causes of Climate Change Damages in Agriculture:

Lack of preparedness



- “Lack of preparedness” was emphasized by 57 respondents, suggesting damages are compounded by insufficient readiness and awareness about the evolving climate landscape.

- “Inadequate infrastructure” is a shared concern, with 45 individuals pointing out that current agricultural infrastructure isn't designed to weather the growing climate adversities.

### 3. Role of Gender in Climate-Adaptive Agricultural Practices:

- “Women's unique challenges” were highlighted by 52 respondents, who pointed out that women face distinct difficulties due to their roles and comparatively limited resources.

- Post-harvest activities, where women are traditionally more involved, present different challenges when climate adversities strike, as mentioned by 38 respondents.

### 4. Influence of Age in Climate-Adaptive Agricultural Practices:

- “Elderly farmers” are believed to be at a disadvantage, with 54 respondents noting that this demographic faces heightened challenges due to physical limitations and potential resistance to new technologies.

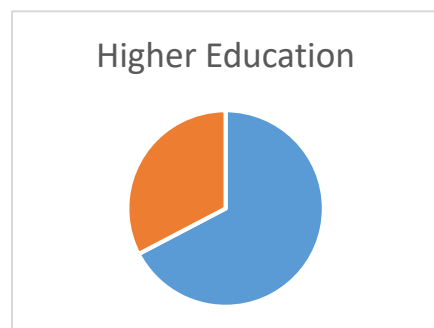
Elderly farmers





- Conversely, 47 respondents pointed out that while younger farmers might be more adaptable, they can struggle due to lack of experience.

### 5. Role of Education in Climate-Adaptive Agricultural Practices:



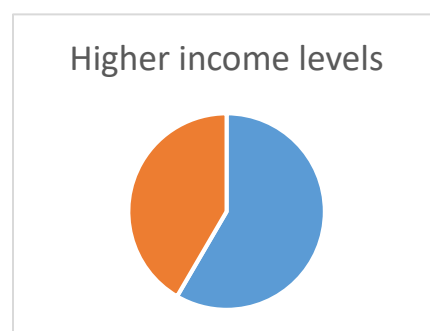
- “Higher education” is seen as a crucial advantage in this context. 68 respondents believe that farmers with a more robust educational background are better equipped to understand and counteract climate change impacts.

- There's a call for specialized climate education, with 33 respondents emphasizing the importance of specific, agriculture-centric climate change training.

### 6. Influence of Income on Climate Resilience in Farming:

- Those with “higher income levels” are perceived as better prepared to handle climate adversities, as indicated by 59 respondents.

- “Low-income farmers”, on the other hand, are seen as more vulnerable due to their limited financial resources, a sentiment shared by 42 respondents.



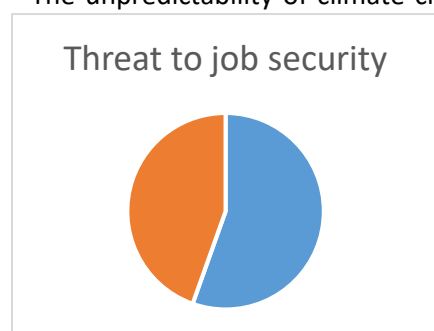
### 7. Strategies to Minimize Climate Change Impacts:

- The role of “education and awareness” emerges as pivotal. 71 individuals underscored the importance of campaigns and initiatives aimed at building resilience.

- “Modern agricultural practices”, driven by advanced technologies, are highlighted by 53 respondents as necessary to address climate change effects.

### 8. Impact of Climate Change on Employment in Agriculture:

- The unpredictability of climate change, as cited by 56 respondents, poses a “threat to job security”, potentially leading to job losses or diminished work opportunities in the sector.



### 9. Health Impacts of Climate Change:

- “Climate-induced health challenges”, encompassing both mental and physical aspects, are a growing concern, shared by 49 respondents.

### 10. Concerns Regarding Food and Nutrition Security:

- The “potential for food shortages” is a significant concern, raised by 58 respondents. They emphasized the challenges in ensuring a consistent food supply due to erratic weather patterns.



- Additionally, 46 respondents voiced worries about a possible decline in the nutritional value of crops, leading to broader health concerns.

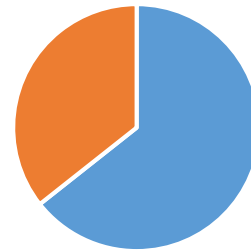
### 11. Impacts on Small-Scale Farmers:

- Small-scale farmers are perceived to be at a “heightened risk” due to climate change. 65 respondents attributed this vulnerability to their limited resources and reliance on traditional farming methods.

### 12. Knowledge About Climate Change in Agriculture:

- There's a “general awareness” about climate change, as expressed by 52 respondents. However, they also noted a specific knowledge gap regarding its direct impact on agriculture.

Small-scale farmers are at a “heightened risk”



The amalgamation of both qualitative and quantitative data offers a comprehensive picture of stakeholder opinions. These insights are invaluable for interventions, policy formulation, and awareness campaigns tailored to the specific concerns raised by the community.

## Qualitative Insights

The comprehensive qualitative analysis allows a deeper understanding of the complex dynamics of climate change impacts on the agricultural sector. These narratives, derived from interviews with stakeholders, present a full picture that goes beyond the numbers, revealing the lived experiences, concerns, expectations and aspirations of those most affected by this global challenge.

### 1. Overall Perception of Climate Change:

The consensus among stakeholders is undeniable: climate change is real, and its impacts on agriculture are obvious. Stakeholders often mention unpredictable weather conditions, characterized by unexpected droughts, unexpected storms or intense floods, which disrupt traditional cropping cycles. Many recalled the cases when plantations/crops were completely destroyed and yields were lost due to sudden climatic events. The need for urgent, timely and accurate dissemination of information about the impact of climate change is reflected in the answers. Stakeholders believe that while awareness of the impact of climate change is growing, there is a significant gap in actionable insights into measures that can help them prepare or adapt in real time to climate change.

### 2. Challenges Faced by Farmers:

While quantitative data highlighted diminishing returns and economic implications, qualitative feedback revealed the deeper emotional and psychological effects of these challenges. There is an evident sense of anxiety among farmers, stemming from the culmination of the struggle with unpredictable yields and the impending uncertainty about their future in agriculture. The unpredictability, which many have mentioned, does not only apply to weather conditions, but also to other aspects of life: children's





education, daily life and livelihood. The emotional toll, combined with financial instability, presents a dual challenge that many farmers find overwhelming and insurmountable.

### 3. Social Drivers of Vulnerability:

Diving deeper into the social aspects, it is evident that the vulnerabilities faced by the stakeholders are not distributed evenly. Women, especially in patriarchal families, often bear the brunt because of their role in agricultural and domestic chores. The elderly, with their physical limitations, often find it challenging to adapt to new technologies or practices. On the other hand, younger farmers, although agile and open to technology, may often lack the experience or resources to implement them effectively. Stakeholders repeatedly emphasize how income levels and educational attainment play a key role in determining one's ability to adapt and respond to climate challenges.

### 4. Importance of Adaptation:

The need for better, more localized climate change adaptation strategies has strong support among stakeholders. Stakeholders recognize the value of modern agricultural technologies, but emphasize the importance of ensuring that these solutions are tailored to local needs. Many respondents suggested initiatives based on the specific challenges of a region as more influential than strategies for wider areas.

### 5. Policy Recommendations:

From the interviews, it is clear that there is a need for more active and inclusive policies. Stakeholders prefer policies that not only prioritize the education of farmers but also facilitate access to resources and technologies. The need for subsidies to promote practices resistant to the impact of climate change is often emphasized. There is a strong interest among farmers to be an integral part of the policy-making process, ensuring that interventions are not just top-down, but are shaped by the real challenges they face in production.

### 6. Future Outlook:

Despite the myriad of challenges, resilience and optimism about dealing with the impact of climate change runs through stakeholder feedback. Stakeholders believe that with the right mix of technology, increased community engagement and adequate support policies, the agricultural sector will be able to successfully cope with the impact of climate change.

In conclusion, qualitative findings highlight the multidimensional nature of climate change impacts. With climate change, not only the cycles of crops that cause financial losses are disrupted, but also the existence, identities and the very structure of rural communities. Addressing these challenges requires holistic solutions that combine technology, policy, and most importantly, voice the needs of those most affected.





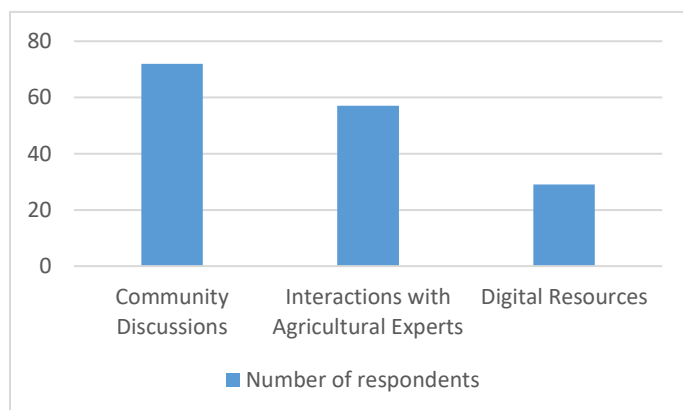
## Adult Learners' Participation and Problem-Centered Focus

Adult learners, especially those involved in the agricultural sector, possess a unique set of experiences, challenges, and learning preferences. Their learning is often more problem-centered, drawing heavily from personal experiences and immediate challenges. Let's delve into the perceptions of the adults in relation to this.

### 1. Participation in Learning Activities:

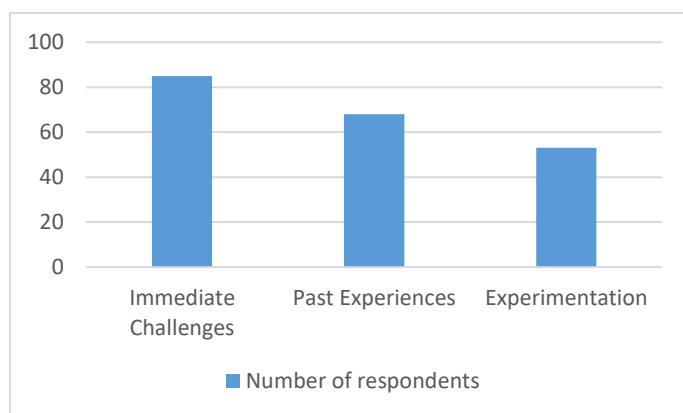
From the interview responses, it's evident that adult actively seek knowledge from various sources.

- **Community Discussions:** A majority of respondents emphasized the importance of community gatherings and discussions. Sharing experiences, successes, and failures in these forums provide them with practical solutions and a sense of camaraderie. 72 of the respondents emphasized the importance of community gatherings and discussions. These forums provide them with practical solutions and a sense of camaraderie.
- **Interactions with Agricultural Experts:** Interactions with agricultural experts were also highlighted. These experts serve as a bridge, translating scientific knowledge into practical advice tailored for the local context. 57 respondents highlighted interactions with agricultural experts. These experts provide tailored advice for the local context.
- **Digital Resources:** A smaller segment of participants mentioned tapping into digital resources, reflecting a trend among the younger or more tech-savvy farmers. However, there's a gap in widespread adoption, possibly due to technological barriers or lack of awareness. 29 participants mentioned tapping into digital resources, reflecting a trend among the younger or more tech-savvy farmers.



### 2. Problem-Centered Learning:

- **Immediate Challenges:** Participants unanimously agreed that their learning is often driven by immediate challenges. For instance, unpredictable weather patterns leading to crop failures would prompt them to seek knowledge on alternative crops or farming



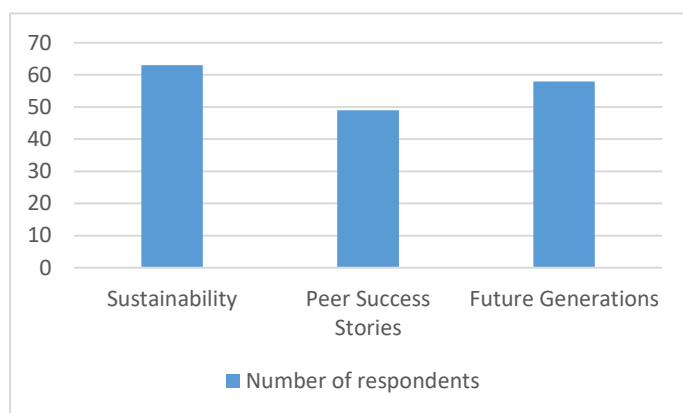


techniques. 85 participants agreed that their learning is driven by immediate challenges. Unpredictable weather patterns or pests would prompt them to seek knowledge on alternative techniques.

- Past Experiences: Many respondents reiterated the value of past experiences. They often referred back to previous years, comparing and contrasting situations. 68 respondents reiterated the value of past experiences. Comparing situations to previous years helps them make informed decisions.
- Experimentation: A significant portion of the participants mentioned their willingness to experiment, especially when conventional methods failed to yield results. This experimental approach is often a mix of traditional knowledge, expert advice, and personal intuition. 53 participants mentioned their willingness to experiment, especially when faced with challenges that conventional methods couldn't address.

### 3. Motivation behind Learning:

- Sustainability: While better yields and profitability are primary motivators, there's an increasing awareness and emphasis on sustainability. Participants expressed concerns over degrading soil quality and water scarcity, indicating a shift towards more sustainable and environment-friendly practices. 63 respondents mentioned sustainability as a driving factor. Concerns over environmental issues like soil degradation and water scarcity were evident.
- Peer Success Stories: Hearing about a peer's success with a new technique or crop variety often serves as a strong motivator. It instills a sense of hope and provides a roadmap to tackle similar challenges. 49 participants were motivated by hearing about a peer's success with a new technique or crop.
- Future Generations: 58 respondents, especially those with families especially those with families, expressed interest in acquiring knowledge that they will use, but also pass on to the next generation.



In summary, the perception of participants underscores the importance of problem-centered learning. Their active participation in learning activities, driven by immediate challenges and motivated by profitability, sustainability, and community welfare, highlights the need for tailored educational resources and strategies that cater to the unique learning preferences of adult in agriculture.

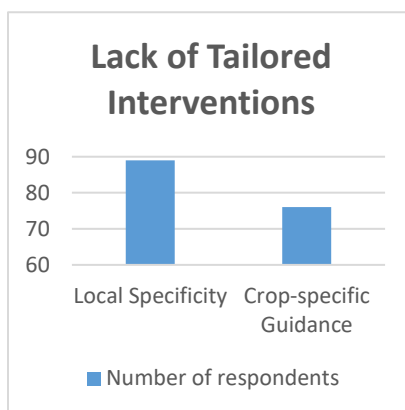


## Policy Gaps

In the realm of climate change and its effects on agriculture, policies play a pivotal role in determining how communities adapt and thrive. Understanding the perceived gaps in existing policies is critical to making effective improvements.

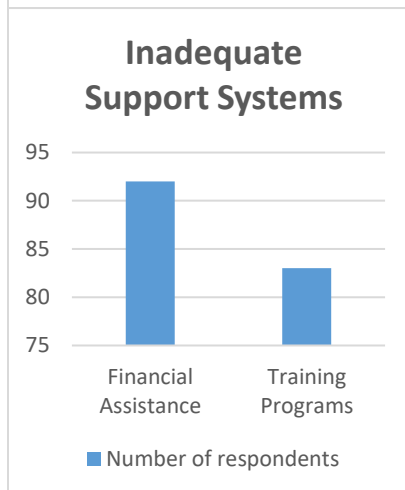
### 1. Lack of Tailored Interventions:

- Local Specificity: 89 respondents emphasized the need for policies tailored to the unique challenges of Rosoman. While national-level policies provide a broad framework, the nuances of local farming practices, soil types, and weather patterns must be addressed at the micro-level.
- Crop-specific Guidance: 76 participants pointed out the absence of guidelines for specific crops, with each having its own set of vulnerabilities and requirements.



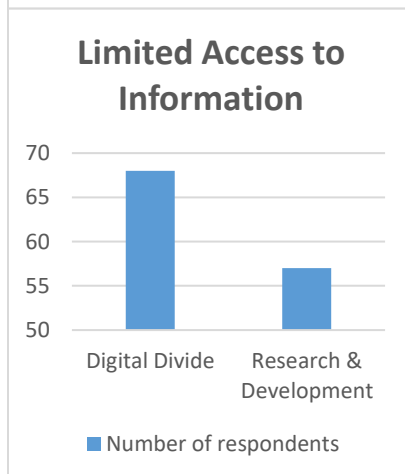
### 2. Inadequate Support Systems:

- Financial assistance: 92 respondents cited the lack of adequate financial support systems. Whether it's subsidies for sustainable agricultural equipment or compensation for crop damage due to unexpected climate events, there is an urgent need for stronger financial safety nets.
- Training programs: 83 participants highlighted the lack of training programs adapted to modern challenges. Respondents expressed particular interest in training on new agricultural techniques, pest control and water conservation practices, which they consider crucial in dealing with the negative impacts of climate change.



### 3. Limited Access to Information:

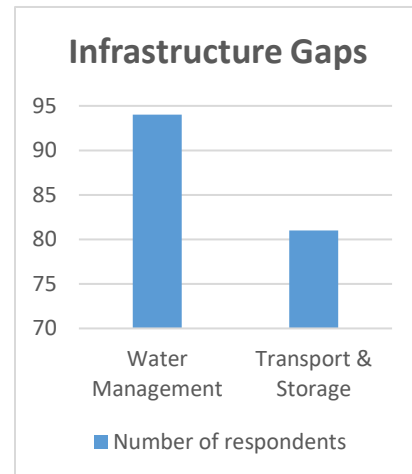
- Digital Divide: 68 respondents cited the digital divide as a significant hurdle. While there's a wealth of information online, not all farmers have the resources or skills to access and interpret this data.
- Research & Development: 57 participants felt that there's not enough research being conducted specific to their region. Local research can offer solutions tailored to the unique challenges of Rosoman.





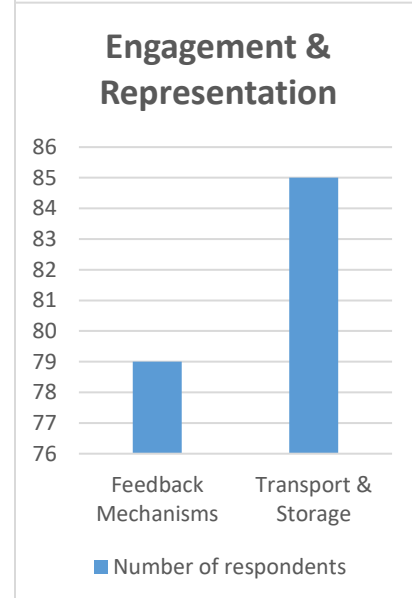
**4. Infrastructure Gaps:**

- Water Management: 94 respondents pointed out the lack of infrastructure to manage water resources efficiently. The changeable weather and instability of rainfall imposes a huge need for efficient water storage and distribution systems.
- Transport & Storage: 81 participants highlighted the challenges they face due to inadequate transport and storage facilities, especially important in ensuring the produce reaches broader markets.



**5. Engagement & Representation:**

- Community Involvement: 79 respondents felt that they're not adequately involved in policy-making processes. Their on-ground experience can offer invaluable insights.
- Feedback Mechanisms: 85 participants expressed the need for robust feedback mechanisms where they can voice concerns, give suggestions, or report issues.



From the data and responses, it is evident that although there are policies in place to deal with the negative impact of climate change, there are significant gaps that need to be addressed. Tailoring interventions to local needs, bolstering support systems, bridging the digital divide, investing in infrastructure, and ensuring active farmer engagement are some areas that policymakers need to focus on.



## Combined Analysis

Climate change, although global in its implications, is mostly manifested at the local level. In the context of agricultural practices, these manifestations can be both subtle and profound, and having an impact will affect not only the economic aspects, but also the very social structure of the communities. The municipality of Rosoman, with its essential dependence on agriculture, has a great need for planning and implementation of measures to prevent or reduce the negative impact of climate change. This research for the municipality of Rosoman will enable a realistic understanding of the situation at the local level and the need to undertake certain activities.

By extracting data from structured questionnaires and in-depth interviews, this analysis aims to provide a comprehensive assessment of the agricultural sector in Rosoman with a particular emphasis on climate change. Quantitative information is obtained through the questionnaire, while the interviews provide information about the experiences of the local population, thus revealing information that is often missed in quantitative assessments.

This section, titled "Combined Analysis", attempts to combine these two types of data, in order to present a comprehensive view of the challenges, adaptations and transformations occurring in the agricultural sector in the municipality of Rosoman. Through a methodical exploration of similarities and differences, impact mapping, community-level considerations, social dynamics and economic repercussions, we aim to show the complex interplay between climate change, agricultural practices and community resilience to climate change.

The following sections will delve deeper into each of these aspects by drawing conclusions and insights based on the data collected. The aim of this comprehensive analysis is not only to provide information, but also to guide policy decisions, interventions and future research in the domain of agriculture and climate change in the municipality of Rosoman.

## Commonalities and Divergences

The data from both the questionnaire and the interviews provide a complete picture of the agricultural sector in the municipality of Rosoman. The information obtained through the two instruments used can be used as two data sets, as separate entities, taking into account the inherent differences in their collection methodologies. But when combined, they represent a synergy that gives a clear and complete picture of the agricultural sector in the municipality of Rosoman.

### - Demographics:

Demographic data from both groups show a dominant representation of men, which indicates that agriculture, at least in the context of the municipality of Rosoman, remains a profession predominantly managed by men. This observation may indicate cultural or economic forces at play that encourage men to farm more often than women. Age demographics further suggest that agriculture mainly supports the middle-aged population, especially those aged 50-54.



This situation raises the question of whether as this age group transitions out of active farming, the younger generation will step up to fill the gap that will arise in the future.

- **Ethnicity:**

The vast majority of respondents in both data sets identify themselves as Macedonians. While this may reflect the ethnic distribution in Rossoman, it also suggests that the experiences and insights captured are largely from the Macedonian community. This uniformity in ethnicity may indicate shared cultural values, practices, and challenges among respondents.

However, not everything is perfectly aligned between the two databases. Divergences appear primarily in the nature and depth of the data.

The questionnaire, as a structured form of data collection, offers broad trends and insight into general community perceptions. It is quantitative, almost clinical in its approach.

In contrast, interviews are imbued with personal narratives, emotions and a depth of understanding that only qualitative data can provide. They reveal the complexities of daily life, the challenges faced by individual farmers and their expectations and aspirations for the future.

## Impact Mapping

Impact mapping involves visualizing and understanding the various effects, direct and indirect, that climate change has on agricultural practices in the municipality. The results of the questionnaires serve as the basis of this map, foreshadowing the significant impacts of climate change. The majority of respondents noticed changes in weather conditions. These are not just statistical anomalies, but tangible changes that have real consequences.

- **Weather Patterns:**

Many farmers reported more frequent and prolonged droughts, interspersed with unpredictable and heavy rainfall. These unpredictable weather events wreak havoc with traditional agricultural cycles, forcing farmers to adapt, often at significantly increased costs.

- **Crop Yields and Pest Activity:**

Reduced crop yields were a common concern among respondents. Prolonged dry spells, together with sporadic heavy rainfall, can damage crops and reduce yields. Additionally, changes in temperature and humidity levels can lead to increased pest activity, which will further affect yield.

The interviews served to form the basis provided by the questionnaire. Participants shared personal stories of how altered agricultural cycles led to reduced yields due to unexpected weather changes. Rising costs associated with pest control, irrigation systems and even crop insurance are recurring themes. For many respondents, agriculture is not just a profession; it is a legacy handed down through generations. The interviews captured the emotional and psychological toll of these challenges, which when taken only in numbers could be overlooked.



The Rosoman municipality, with its distinct agricultural character, has been a focal point for understanding the broader implications of climate change. The questionnaire, which captured the responses of hundreds of participants, provides an essential foundation for this exploration.

**- Demographics:**

The obtained data indicate a clear predominance of male respondents, which suggests that the roles of holders of agricultural holdings in the municipality of Rosoman are predominantly occupied by men. This gender divide is not just a statistic; it speaks to entrenched social roles and perhaps even access to resources and decision-making authority within the community.

The age distribution further deepens our understanding. A significant part of the respondents belong to the middle-aged category, especially those aged between 50 and 54 years. This statistic not only highlights the demographic most actively engaged in agriculture, but also raises critical questions about the inheritance and future of agriculture in the municipality of Rosoman.

**- Ethnic Distribution:**

Approximately 90% of respondents identified as Macedonian, offering a predominantly Macedonian perspective on the challenges and opportunities posed by climate change. While this might reflect the ethnic makeup of Rosoman, it also places emphasis on the need to consider diverse voices and experiences in future studies.

**- Divergent Narratives:**

While the questionnaire offers a broad overview, the interviews offer depth. They bring to light the daily struggles, the challenges of adapting to new farming techniques in the face of unpredictable weather patterns, and the emotional toll these changes exert on individuals and families.





## Municipal-Level Analysis

Analysis at the municipality level offers a panoramic view, covering both individual challenges and broader systemic issues. The data points to a community at a crossroads. Although there is tangible awareness of climate change, with over 75% of respondents perceiving noticeable changes in the past decade, infrastructure and support mechanisms still lag behind

### Infrastructure Needs:

A recurring theme, both in the questionnaire and interviews, was the pressing need for robust irrigation systems. Given the erratic rainfall patterns, traditional rain-fed farming approaches are becoming increasingly untenable.

### Training and Knowledge Dissemination:

Over 65% of respondents expressed a desire for more training and resources to help navigate the challenges posed by climate change. This speaks to a community eager to adapt but constrained by a lack of resources and knowledge.

## Social Dynamics

In the municipality of Rosoman, agriculture plays a key role in connecting the community, cultural practices and generational transfer of knowledge.

### Community Cohesion:

Challenges such as reduced yields or unseasonal rains aren't faced in isolation. They are collective challenges, forging stronger community bonds. The shared experience of navigating the vagaries of climate change has fostered a spirit of collaboration and mutual support.

### Generational Considerations:

However, beneath this cohesive exterior lie generational rifts. The younger generation, with aspirations molded by global influences and opportunities, often exhibit a diminishing interest in farming. This trend, captured in both the questionnaire and interviews, poses profound questions about the future of farming in Rosoman and the potential erosion of deeply-held community values and practices.





## Economic Aspects

The economic ramifications of climate change on Rosoman's agriculture are multifaceted. The questionnaire paints a stark picture: reduced profitability, increased costs, and an uncertain future. Nearly 60% of respondents expressed concerns about the economic viability of continuing farming in the current climate scenario.

### Profitability Concerns:

Decreased crop yields directly affect profitability. Coupled with increased expenses—be it for pest control, irrigation systems, or infrastructure adaptation—many farmers find themselves grappling with financial challenges.

### Diversification and Adaptation:

The interviews offer a more granular perspective. Many farmers spoke of diversifying their crops, exploring alternative income avenues, or even contemplating migration to urban centers in search of more stable economic opportunities.

Climate changes and their multidimensional impact on agricultural practices, especially at the municipal level, require a detailed and systematic approach to data analysis. Through this assessment, it is necessary to reveal the explicit and implicit consequences of climate change, focusing on the social aspects of the population in the municipality of Rosoman. This analysis is based on the vast data collected from various sources such as structured questionnaires, in-depth interviews and comprehensive literature reviews. The collected data offer a lot of information, but do not give a complete picture of climate change due to their size. To get real value and insights from the collected data, a precise process of checking, cleaning, transforming and interpreting the data is used.

Within data analysis, the role of anomaly detection is of paramount importance. By identifying data points or observations that deviate from established information or norms, both challenges that need immediate attention and opportunities that need to be exploited can be pinpointed. In this study, the collected data are not only statistical indicators, but can also be used as indicators for deeper socio-economic and environmental research.



## Data Analysis and Anomaly Detection

### Listed Observations of Potential Anomalies:

**Gender Disparity in Responses:** One of the glaring observations was the overwhelming male representation in the questionnaire respondents from Rosoman Municipality. While on the surface this might seem like a simple statistical skew, it beckons deeper questions.

*Does this distribution mirror the actual demographic structure of Rosoman?*

*Or does it highlight potential biases in survey distribution, accessibility, or even cultural nuances that might deter certain gender groups from participation?*

**Perception vs. Reality Gap:** An intriguing revelation was the dichotomy between respondents' acknowledgment of climate change effects on agriculture and their awareness of adaptive strategies. The data suggested that while the former was widely recognized, knowledge about mitigation techniques and technologies was markedly lacking. This disparity is a call to action to bridge the information gap and empower the community with the knowledge they need.

**Educational Paradox:** The data unveiled a striking paradox. Respondents, almost unanimously, underscored the importance of education in navigating the challenges of climate change. Yet, a significant portion expressed dissatisfaction with the current educational offerings on the topic. This highlights a potential void in either the content, delivery, or accessibility of educational resources.

**Qualitative-Quantitative Divergence:** Another anomaly was potential variations between the insights from the structured questionnaires and the more subjective interviews. Such divergences might hint at deeper underlying narratives or perceptions that quantitative data alone might overlook.

### Reasons for Consideration:

**Holistic Policy Formulation:** Recognizing and addressing anomalies ensures that any resultant policies, strategies, or interventions are rooted in a comprehensive understanding of Rosoman's unique challenges and opportunities, rather than being influenced by potentially skewed or isolated data points.

**Strategic Resource Deployment:** By understanding the nuances and intricacies highlighted by these anomalies, resources – be it financial, human, or technological – can be deployed more strategically, ensuring maximum impact and efficiency.

**Community-Centric Engagement:** Anomalies related to awareness, perception, or even demographic representation underscore the need for more tailored community engagement strategies. By understanding and addressing the unique needs, challenges, and perspectives of various community segments, interventions can be made more inclusive and effective.



**Future-Proofing Rosoman:** Addressing current anomalies isn't just about redressing present challenges; it's about equipping Rosoman for the future. By understanding and acting upon these anomalies, we can ensure that the municipality is not only resilient to the current impacts of climate change but is also prepared for future scenarios, challenges, and opportunities.

Through this rigorous process of data analysis and anomaly detection, our aim is to provide Rosoman Municipality with actionable insights that can shape a sustainable, resilient, and inclusive future for all its residents.

## Knowledge Gaps

The intricate tapestry of Rosoman Municipality's agricultural landscape, woven with traditions, practices, and lived experiences, has borne witness to the undeniable shifts brought about by climate change. Through the comprehensive assessment process, which amalgamated insights from structured questionnaires, in-depth interviews, and a thorough literature review, certain patterns began to emerge. Foremost among these patterns was the existence of profound knowledge gaps within the farming community. These gaps not only signify the challenges at hand but also chart the path forward, illuminating areas in dire need of intervention and education.

### Understanding the Depth of the Gap:

At the heart of this assessment was the desire to understand the nexus between climate change, agricultural practices, and the socio-economic dynamics of Rosoman Municipality. The sheer diversity and richness of the data collected offered a multi-dimensional view of the issues at hand. Yet, as the data was parsed, cleaned, analyzed, and interpreted, certain gaps became evident.

Farmers in Rosoman, deeply attuned to the rhythms of nature, have experienced firsthand the vagaries of shifting weather patterns, unpredictable rainfall, and altering crop yields. Their narratives, both through questionnaires and interviews, painted a picture of a community grappling with change, often with limited tools at their disposal. While there was a tangible understanding of the effects of climate change, a deeper dive into the data revealed gaps in their comprehension of its broader ramifications.

### Delineating the Gaps:

The data collected, when analyzed through the lens of anomaly detection, brought to fore several anomalies or outliers that signaled deeper underlying knowledge gaps. For instance:

**Perception vs. Ground Reality:** Farmers, through their lived experiences, recognized the adverse effects of climate change on their crops. However, when probed further, many could not delineate the broader climatic patterns or the science underpinning these changes. This gap between perception and the underlying reality underscores the need for foundational education on climate science.

**Adaptive Practices and Technologies:** The world of agricultural science and technology is continually evolving, offering a suite of solutions designed to mitigate the impacts of climate change. Yet, a significant



portion of respondents expressed unfamiliarity with these adaptive technologies. This is not just a gap in awareness but possibly also in access, both physical and financial.

**Resource Optimization:** Among those who were aware of certain adaptive products or resources, there was a discernible lack of knowledge on their optimal utilization. This is indicative of the need for practical, hands-on training tailored for the unique challenges and resources of Rosoman.

**Educational Ecosystem:** An overwhelming sentiment that resonated across both the questionnaire responses and interviews was the perceived inadequacy of the current educational ecosystem. While farmers acknowledged the centrality of education in navigating the challenges of climate change, many felt that the available resources, both in terms of content and delivery mechanisms, fell short.

### Zooming into Educational Topics:

The assessment also sought to understand the specific educational needs and topics that the farming community deemed crucial. Several themes emerged:

- **Foundations of Climate Science:** Before venturing into the nuances of adaptive practices, there's a clear need to build a strong foundation. Farmers expressed the desire to understand the basics of climate science, the global patterns, and the localized implications for Rosoman.
- **Sustainable Farming in the Age of Climate Change:** As the specter of climate change looms large, traditional farming practices need to evolve. Training on sustainable farming practices, which harmonize productivity with ecological balance, was deemed essential.
- **Technological Training:** In the age of rapid technological advancements, staying updated is not just an advantage but a necessity. Farmers expressed the need for hands-on training on the latest agricultural technologies, especially those tailored for climate change mitigation.
- **Risk Management and Proactive Planning:** One of the recurrent themes was the unpredictability brought about by climate change. Farmers expressed the need for training on risk management, forecasting, and proactive planning to navigate these uncertainties.

### Recommendations for Bridging the Gap:

Given the knowledge gaps illuminated by the assessment, certain targeted recommendations emerge:

1. **Holistic and Integrated Training:** The training modules designed for the farmers of Rosoman need to be holistic, blending theoretical insights with practical applications. Such a program should be crafted keeping in mind the unique challenges, resources, and socio-cultural dynamics of Rosoman.
2. **Localizing Content:** While climate change is a global phenomenon, its manifestations are often localized. The training content, while drawing from global best practices, should be rooted in the local context of Rosoman, making it both relevant and relatable.
3. **Expert Collaborations:** To ensure the scientific rigor and practical applicability of the training modules, collaborations with experts are imperative. Engaging with climate scientists, agronomists, and educators can bring a multi-disciplinary richness to the content.



- 4. Feedback Mechanisms:** Although initial training modules can be based on assessment findings, it is critical to establish feedback mechanisms. This will ensure that the training is developed, iteratively based on the real experiences, challenges and needs of the farmers.

Municipality of Rosoman is affected by climate change, which is a global problem. The dealings of Rosoman municipality with climate change as a local community indicate its challenges, aspirations and gaps in knowledge that need to be bridged. This assessment ensures the creation of a durable, informed and adaptable plan with which the municipality of Rosoman will undertake the necessary measures and activities to deal with climate change.



## Recommendations

The agricultural sector of the municipality of Rosoman, as stated in the comprehensive assessment, is the main economic activity. This sector faces all challenges and opportunities, including the ever-evident climate changes. The interaction of socio-economic dynamics, agricultural practices and environmental changes create a complex situation that requires identified interventions. In this chapter, outstanding issues will be highlighted and action proposals will be made to resolve them.

## Suggestions

### **Comprehensive Climate Education:**

**Contextual Curriculum:** Developing an educational curriculum that marries the global understanding of climate change with the specific challenges and experiences of Rosoman's farmers. This would ensure that the knowledge imparted resonates with the lived experiences of the local community.

**Regular Updates:** As climate science is a rapidly evolving field, periodic reviews and updates to the curriculum are essential to keep farmers abreast of the latest findings and best practices.

### **Promotion of Adaptive Technologies:**

**Showcase Sessions:** Organizing regular showcase sessions where providers can introduce farmers to the latest adaptive technologies. These sessions can serve as a platform for knowledge exchange, questions, and hands-on demonstrations.

**Subsidized Access:** Collaboration with technology providers to offer these solutions at subsidized rates or through easy installment plans, ensuring financial accessibility.

### **Strengthened Community Engagement:**

**Feedback Platforms:** Establishing digital and offline platforms where farmers can provide real-time feedback on interventions, policies, and training programs. This feedback-centric approach ensures that interventions remain aligned with the ground realities.

**Promotion of Indigenous Practices:** Documentation and promotion of local farming practices that have historically shown resilience. Organize community sessions where elder farmers can share their knowledge with the younger generation.

### **Socio-Economic Support Mechanisms:**

**Targeted Programs:** Development of specialized programs that offer support to the most vulnerable groups within the farming community, ensuring they have the resources and knowledge to adapt effectively.



**Migration Support:** Establishing support centers that provide resources, counseling, and training for those affected by climate-induced migration, ensuring their smooth transition and adaptation.

**Infrastructure Enhancement:**

**Focused Investments:** Direct investments towards infrastructure projects that directly bolster climate resilience, such as water conservation systems, sustainable irrigation, and crop storage facilities.

**Public-Private Partnerships:** Engaging with private entities to co-fund and co-develop infrastructure projects, leveraging their expertise and resources.

## Open Issues

**Evolving Nature of Climate Change:**

The unpredictability and dynamism of climate change mean that today's solutions might not address tomorrow's challenges. Continuous research and adaptability are key to staying ahead of these challenges.

**Accessibility and Reach of Educational Programs:**

Despite the introduction of educational initiatives, reaching every farmer, especially those in remote areas or belonging to marginalized groups, remains a challenge. Innovative delivery mechanisms and localized content are essential.

**Integration of Local and Global Knowledge:**

The challenge lies in creating a harmonious blend of global scientific insights and local traditional practices. Ensuring that neither is undervalued is crucial for holistic adaptation.

**Sustainability of Interventions:**

Beyond the initial introduction of technologies or practices, the long-term sustainability, maintenance, and evolution of these interventions are areas that need focused attention.

**Stakeholder Alignment:**

With multiple stakeholders involved: farmers, policy makers, experts, private entities, cohesive cooperation and alignment of interests is ensured. This is a complex challenge that requires continuous effort.

These recommendations emphasize the importance of a multidimensional approach based on community engagement, continuous learning and adaptability. The municipality of Rosoman will deal with the impact of climate change through proactive strategies and reactive solutions. The recommendations are that the municipality of Rosoman be prepared for the challenges ahead and take advantage of the opportunities that will arise.





## Next Steps and Action Items

In the face of the insights and challenges highlighted by the assessment, the journey ahead for Rosoman Municipality necessitates a structured plan of action. This section delineates the immediate next steps and specific action items, including the pivotal task of crafting a holistic strategy.

### 1. Development of a Comprehensive Strategy:

**Action:** Initiation of a series of brainstorming sessions, workshops, and consultations to develop a comprehensive climate adaptation strategy tailored for Rosoman Municipality's agricultural sector.

**Purpose:** A well-defined strategy will serve as the blueprint for all subsequent interventions, ensuring alignment with the overarching goals and vision for a resilient agricultural landscape.

### 2. Establishment of a Municipal committee for climate changes:

**Action:** Constitution of a dedicated committee that will oversee the strategy's development and its subsequent execution. This body should comprise local agricultural experts, community leaders, representatives from the farming community, and other relevant stakeholders.

**Purpose:** The committee will be instrumental in guiding the strategy formulation, ensuring it reflects the unique challenges, aspirations, and resources of Rosoman.

### 3. Stakeholder Consultations for Strategy Development:

**Action:** Organization of focused group discussions, surveys, and consultations to garner inputs from farmers, experts, and community members for the strategy.

**Purpose:** Grounding the strategy in grassroots insights ensures its relevance, acceptance, and effectiveness.

### 4. Strategy Documentation and Dissemination:

**Action:** Once formulated, document the strategy in a comprehensive yet accessible manner. Dissemination of the strategy widely through community meetings, digital platforms, and local media.

**Purpose:** Ensuring the community is well-informed about the strategy fosters collective ownership and collaboration in its implementation.

### 5. Pilot Programs:

**Action:** As part of the strategy's execution, launching pilot programs to test new initiatives. These can range from educational workshops to the introduction of adaptive technologies.

**Purpose:** Pilots provide a safe environment to test interventions, gather feedback, and refine approaches before a broader rollout.

### 6. Infrastructure Assessment:

**Action:** Conducting a thorough assessment of the existing agricultural infrastructure in Rosoman Municipality.





**Purpose:** This will help in identifying critical areas that need immediate attention and investment, ensuring that resources are channeled effectively.

#### **7. Community Feedback Systems:**

**Action:** Development of both digital and offline systems where farmers and community members can provide continuous feedback on various initiatives.

**Purpose:** A feedback-centric approach ensures that interventions remain agile and responsive to the evolving needs of the community.

#### **8. Resource Allocation and Fundraising:**

**Action:** Initiation of efforts to allocate necessary funds for the proposed interventions. This includes both reallocating municipal funds and seeking external grants or partnerships.

**Purpose:** Ensuring financial readiness is crucial for the smooth implementation of the recommendations.

#### **9. Collaboration with Research Institutions:**

**Action:** Forging partnerships with academic and research institutions that focus on climate science and sustainable agriculture.

**Purpose:** This collaboration can bring in scientific rigor, research insights, and technological innovations, ensuring that Rosoman stays at the forefront of adaptive agricultural practices.

#### **10. Continuous Monitoring and Reporting:**

**Action:** Establishing mechanisms for continuous monitoring of the implemented initiatives. Regularly reports on the findings, challenges, and successes to the community and stakeholders.

**Purpose:** Monitoring ensures accountability, tracks progress, and offers insights for future refinements.

#### **11. Public Awareness Campaigns:**

**Action:** Launching public awareness campaigns, leveraging local media, community meetings, and digital platforms, to keep the community informed about climate change and the ongoing interventions.

**Purpose:** An informed community is more likely to participate actively and collaboratively in adaptation measures.

#### **12. Periodic Review Meetings:**

**Action:** Scheduling bi-annual review meetings with the committee, community representatives, and other stakeholders.

**Purpose:** These meetings will assess the progress, address any emerging challenges, and recalibrate the approach if needed.



## Conclusion

The agricultural sector of Rosoman municipality, intertwined with its rich history, traditions and community spirit, stands at a crossroads facing concrete challenges. As climate change is felt more and more, reshaping ecosystems and altering long-standing practices, the need for proactive adaptation and building resilience is becoming more pronounced.

The assessment undertaken to measure the social impact of climate change on agriculture in the municipality of Rosoman was derived from the need to locate the impact of climate change at a specific local level. Through a precise combination of structured questionnaires, in-depth interviews and comprehensive literature reviews, a multidimensional picture of the current scenario of climate change in Rosoman municipality emerged. This assessment, rich in its information and data, offers insight into the perceptions, challenges, opportunities and knowledge gaps that define the agricultural sector in Rosoman Municipality today.

Key findings highlight the tangible changes in weather conditions, the resulting effects on crop yields, and the wider socio-economic implications these changes introduce with the unpredictability and challenges of climate change. Their narratives, echoing both resilience and concern, underscore the need for targeted interventions.

The assessment identifies the adaptive spirit of the community, their willingness to learn and their aspirations for a sustainable and prosperous future. This optimism, coupled with the right resources, knowledge and support, can be the foundation on which the sustainable future of Rosoman Municipality is built.

The recommendations and action items, which are rooted in the findings from the assessment, serve as the direction in which the municipality of Rosoman will move in the coming period. They emphasize the importance of community engagement, education, infrastructure development and continuous monitoring. Furthermore, the emphasis on crafting a comprehensive strategy underscores the need for a structured and long-term approach to overcoming the challenges ahead.

The local stories, the individual narratives of the farmers, the stories of the fields and crops and the aspirations of the community will define the actions of the municipality of Rosoman in dealing with the negative effects of climate change. The way forward. It is expected that the municipality of Rosoman will not only successfully deal with the challenges of climate change, but also show resilience, ensure innovation and sustainable growth.



## Limitations and Future Research

In any comprehensive assessment, recognizing and articulating its inherent limitations is crucial to ensure both transparency and the identification of areas for future inquiry. This chapter delineates the boundaries within which the current study was conducted and points towards directions for subsequent research endeavors.

### Limitations

#### Scope of Data Collection:

While the assessment employed a mix of methodologies like questionnaires, interviews, and literature reviews, it was confined to a specific geographic region and demographic. This might limit the generalizability of some findings to broader contexts.

#### Temporal Constraints:

The study provides a snapshot of the perceptions, practices, and challenges at a particular point in time. Climate change and its impacts are dynamic, and the current findings might evolve with time.

#### Subjectivity in Qualitative Data:

While qualitative interviews offer rich insights, they are also subject to individual biases and interpretations. The narratives captured might reflect personal experiences rather than broader trends.

#### Potential Response Bias:

In any survey or questionnaire-based study, there's always a possibility that respondents might provide answers they deem socially desirable or acceptable, rather than their genuine beliefs or experiences.

#### Depth of Exploration:

Certain themes, especially those concerning socio-economic impacts like migration or health, might require more in-depth exploration than what was possible within the scope of this assessment.

### Future Research

#### Longitudinal Studies:

To truly understand the evolving impacts of climate change on agriculture, future research could adopt a longitudinal approach, tracking changes over extended periods.

#### Broader Geographic Scope:

Expanding the study to encompass other municipalities or regions can offer comparative insights and highlight unique challenges and best practices across different areas.



### **In-depth Socio-Economic Analyses:**

Given the intricate interplay between climate change, agriculture, and socio-economic dynamics, future studies can delve deeper into specific themes like health impacts, migration patterns, or economic shifts.

### **Collaborative Multi-disciplinary Studies:**

Engaging experts from various fields, such as climate science, economics, sociology, and agriculture, can bring diverse perspectives and a more holistic understanding of the challenges and solutions.

### **Technology and Innovation:**

Research focusing on the role of technology, both in terms of understanding climate impacts and offering adaptive solutions, can be pivotal. This might encompass studies on new agricultural techniques, monitoring tools, or predictive modeling.

### **Community-driven Research:**

Engaging the community not just as respondents but as active participants in the research process can lead to more grounded, relevant, and actionable insights.

While the current assessment offers a foundational understanding of the landscape, the journey of inquiry is continuous. Each limitation presents an opportunity, a new avenue for exploration. As Rosoman Municipality continues its quest for resilience and adaptation, ongoing research will be a beacon, illuminating the path, refining strategies, and ensuring that the community's steps are grounded in knowledge, foresight, and collective wisdom.



## Appendices

### Questionnaire Instrument

The survey questions were created by OMNIA and aims to collect quantitative data that will be complementary to the qualitative data derived from semi-structured interviews. Having both kind of data will ensure the validity and reliability of results. Besides this, the partnership will be able to compare results of interviews to the results derived from the survey and highlight potential disparities accordingly. In addition to this, the survey will enable municipality of Rosoman to reach wider number of target groups who experience geographical and social difficulties at the local level. The survey was created by Google Forms, involves 32 questions, and will be translated in Macedonian language to ensure understanding of the questions. The survey will be distributed to 900 farmers, agricultural professionals, natural resource professionals, policy makers, and/or other stakeholders.

The following questions are intended to use during the preparation of the survey:

Demographic Questions:

- 1-Gender
- 2-Age
- 3- Profession
- 4- Nationality
- 5- Migration Status
- 6- Income Level
- 7- Education Level

Survey Questions – Focusing on Effects of Climate Change

- 8- Please rate effects of climate change on crops. Very High/Above Average/Average/ Below Average/Very Low
- 9 - Please rate effects of climate-based disasters on you as a farmer. Very High/Above Average/Average/ Below Average/Very Low

Survey Questions – Focusing on Social Drivers/Impacts

- 10- Can you please rate the order of significance among the underlying reasons for the damage caused by climate change?



- a. Lack of knowledge on how to cope with its negative effects
- b. Lack of available resources (i.e., tools)
- c. Lack of preparation
- d. Lack of experience
- e. Lack of education
- f. Lack of governmental support

11- Do you think impact of climate change sensitive disasters vary depending on the age of a farmer? Yes, No, Not Available.

12- If yes, which age-range do you think experience the most negative consequences associated with the climate-sensitive diseases? 18-24, 25-34, 35-44, 45-54, 55-64 and 65 and over.

13- Can you please specify why you think the impact is higher among those age groups?

14- Do you think impact of climate change related disasters vary depending on the gender of a farmer? Yes, No, Not Available.

15- If yes, which gender do you think experience the most negative consequences associated with the climate-sensitive diseases? Male, Female

16- Can you please specify why you think the impact is higher among this specific gender?

17- Please rate impacts of climate change on health. Very High/Above Average/Average/ Below Average/Very Low

18- Please rate impacts of climate change on food and nutrition. Very High/Above Average/Average/ Below Average/Very Low

19- Please rate impacts of climate change on small-scale farmers. Very High/Above Average/Average/ Below Average/Very Low

20- Please rate impacts of climate change on employment in agriculture. Very High/Above Average/Average/ Below Average/Very Low

21- Please rate the effects of climate change on population migration. Very High/Above Average/Average/ Below Average/Very Low

Survey Questions – Knowledge-gap Questions

22- Please rate the degree of knowledge you have about effects of climate change. Excellent/Above Average/Average/Below Average/Very Poor

23 - Please rate the degree of knowledge you have about adaptation measures. Excellent/Above Average/Average/Below Average/Very Poor.



24- Are you aware about the existence of potential products/resources that can help to cope with the negative effects of climate change in your agricultural practices? Yes, No, Not Available

25- If yes, are you using those products/resources throughout your agricultural practices? Yes, No, Not Available.

26 – If yes - please specify which products you are using and how you are implementing those products into your agricultural practices?

27- Can you please rate the availability of those products/resources in your region? Very High/Above Average/Average/ Below Average/Very Low

28- Are you aware of agricultural technologies that can minimize negative consequences associated with the climate change? Yes, No, Not Available

29 - If yes, please specify which agricultural technologies you are using and how you are implementing those technologies into your agricultural practices?

30- Please rate the importance of education on the ability to cope with climate change related disasters? Very important/ Important/Fairly important/Slightly important/Not important

31- Do you think you are provided enough education regarding the effects of climate change on local farming practices? Yes, No, Not Available.

32- If no, can you please the rate order of importance of topics that need to be integrated in the educational part of Municipal Strategy for Climate Change Adaptation in Rosoman?

a-Information about climate change in general

b- The relationship between climate change and local level farming practicing

c- Adaptation measures of climate change

d- Social drivers of climate change that create vulnerabilities among specific groups (e.g., gender, age, educational level, income level, migration policies).

e- Social impacts of climate change on health, food and nutrition security, and size of farms)

f- Information about agricultural technologies

g- Practical information about how to handle effects of climate change

## Interview Guide

Semi-structured interviews include pre-determined open-ended questions that allow to open a discussion on the topic of interest and to explore gaps and needs that are additional to the questions addressed to the participants. Partner OMNIA has developed a set of questions to be used by Rosoman Municipality in



order to collect qualitative data from target groups (eg farmers, agricultural professionals, etc.). As the type of those interviews involve a semi-structured nature, it will allow flexibility for the interviewers to uncover needs/impacts/consequences that are not predetermined and planned in advance. That is, as a partnership, we aim to have predetermined open-ended questions to guide the interview, but at the same time we aim to allow interviewees the flexibility to share their additional concerns/needs/practices that have been overlooked by the predetermined set of questions.

Semi-structured interviews will be conducted with at least 100 farmers, agricultural professionals, environmental sector professionals, policy makers and/or other stakeholders. The interviews will take place either individually or in the format of focus groups in which 4-5 participants will be involved. These interviews are expected to last one hour per interview. At the beginning of the interview, participants will be provided with an informed consent that highlights the brief purpose of the project, the purpose of the interview, the likely use of the data, and the limitations of confidentiality. The information written in the informed consent will also be presented orally to the participants. Participants will participate in interviews only if they agree to participate and sign the informed consent as proof of their voluntary participation. The informed consent was prepared by the partner OMNIA (please see the document named "informed consent").

The main focus of interview questions will be based on the general effects of climate change on local agricultural practices, social drivers of vulnerability to the effects of climate change, social impacts of climate change and knowledge gaps related to climate change and its related concepts. It is important to note that the interview questions and the informed consent were also translated into the Macedonian language to ensure optimal understanding for those whose mother tongue is Macedonian. For those who migrate to Macedonia, they will be offered the option of English if they do not know how to speak Macedonian fluently.

The predetermined set of questions for the semi-structured interviews are as follows:

- 1- Gender/Age/Nationality/Profession/Migrations status (i.e., demographic questions)
- 2- Can you please describe the effects of climate change on crops? (i.e., about general effects of climate change)
- 3 - Can you please describe the impact of climate-based disasters on you as a farmer? i.e., about general effects of climate change)
- 4 – What do you think about underlying causes of damage caused by climate change in agricultural sector in Rosoman (i.e., about social drivers of vulnerability).
- 5 – How do you think gender can play a role in agricultural-based practices under the conditions of climate change? (i.e., about social drivers of vulnerability)
- 6 -How do you think age can play a role in agricultural-based practices under the conditions of climate change? (i.e., about social drivers of vulnerability)





7 -How do you think educational level can play a role in agricultural-based practices under the conditions of climate change? (i.e., about social drivers of vulnerability)

8 -How do you think income can play a role in agricultural-based practices under the conditions of climate change? (i.e., about social drivers of vulnerability)

9- How do you think negative consequences associated with climate change can be minimized in the future in agricultural sector? (i.e., about social impacts of climate change)

10- What do you think about the effects of climate change on employment in agricultural sector? (i.e., about social impacts of climate change)

11- What do you think about the effects of climate change on health? (i.e., about social impacts of climate change)

12- What do you think about the effects of climate change on food and nutrition security? (i.e., about social impacts of climate change)

13- What do you think about the potential impact climate change on small-scale farmers? (i.e., about social impacts of climate change)

14- What do you know about the climate change in the agricultural sector? (i.e., about assessing knowledge gap)

15- What do you know about adaptation measures in the agricultural sector? Please discuss potential technical and social limitations of those adaptation measures (i.e., about assessing knowledge gap)

16- What do you know about potential products/resources that resist against the negative effects of climate change in your agricultural practices? Can you provide information about availability of those products? (i.e., about assessing knowledge gap)

17- What do you think about the role of agricultural technology that have potential to minimize negative consequences of climate change? (i.e., about assessing knowledge gap)

18- What do you think about the importance of agricultural education (e.g., effects of climate change, adaptation measures, available products/resources)? How do you think this education can be incorporated to the framework of municipality climate change strategy?



## References

Municipality of Rosoman - Information about the geographical location, the population, the agricultural sector, etc. <https://opstinarosoman.gov.mk>

Administration for Hydrometeorological Affairs of the Republic of Macedonia (UHMR) - Data from the Automatic Meteorological Station Gradsko, Veles, located at a location with coordinates  $\varphi = 41^{\circ} 34'$  and  $\lambda = 21^{\circ} 56'$  and altitude 197m. <https://uhmr.gov.mk>