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Influence of socioeconomic and socio-political status on climate-change adaptive capacity of farmers in the Gaza Strip - Palestine

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Summary

Climate change has become a pressing concern of scientific community in recent decades. The Gaza Strip, and Palestinian territories generally, started in the last decade to touch manifestations of climate change, most apparently in agriculture. Furthermore, the Gaza Strip has been suffering from poor socioeconomic situation resulting from political turbulences since 2006. Both climate change effects and declining political and economic situations have reflected on farmers' adaptive capacity to climate change.

This study investigates climate change components that might have the highest appearance and greatest influence on agriculture in the Gaza Strip. The study also measures the influence of socioeconomic situation (certain dimensions such as education, disability, family monthly income, and land ownership) on Gazan farmers' adaptive capacity to climate change. Socio-political influence in the same vein is also discussed, with concentration on dimensions such as decentralization of water resources, armed conflict, satisfaction with laws and regulations, and female empowerment.

Different research tools have been used in this research, namely: desk research (investigating climatology history based on Climate Data Store records), focus groups, interviews and survey.

The study revealed that heat rise, and rainfall fluctuation and scarcity have been steadily growing in the region during the last decades. This result was confirmed in focus groups by farmers who emphasized on the negative effects of these changes on the quantity and quality of their crops in the last decade.

Survey showed that the adaptive capacity to climate changes (especially heat rise, and rainfall fluctuation and scarcity) of farmers in the Gaza Strip is moderate (close to low) with relative weight of 63.2%. Upon survey results, the following socioeconomic factors are seen as statistically significant in their influence on adaptive capacity of farmers in Gaza: governorate where a farmer lives and works, education level, number of sessions, workshops, or trainings a farmer attended on climate change, years of experience in agriculture, and family monthly income.

Regarding socio-political status, the following factors are seen as statistically significant in their influence on adaptive capacity of farmers in Gaza: drinking water quality in house, water source for irrigation, distance between land and irrigation source, the extent of accepting regulations and laws organizing agriculture sector, distance between farm and Israeli fence 'no-go zone', and percentage of working females in farm.

Keywords

Socioeconomic status, Socio-political status, Climate change, Adaptive capacity, Palestinian farmers, Gaza Strip.

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Abbreviations

IHS	Institute for Housing and Urban Development Studies.
IPCC	Intergovernmental Panel on Climate Change.
UNFCCC	The United Nation's Framework Convention on Climate Change.
AIP	American Institute of Physics.
UNRWA	United Nations Relief and Work Agency.
CDS	Climate Data Store.
NIS	New Israeli Shekel (currency in the Palestinian territories).
ARIJ	Geographic Information Systems (GIS) and Remote Sensing Unit of the Applied Research Institute.
NGOs	Non-governmental Organizations

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Chapter 1. Introduction

1.1 Background information

As a result of the current population boom, climate change impacts are growing more pronounced, affecting climatic conditions, health, the environment, and economics. (Allam et al., 2020). Heat stress, for example, is one of the climate change manifestations threatening food security on a global scale. The productivity of vital crops such as wheat, maize, rice and soybean is drastically reduced due to high temperature waves (Teixeira, 2013). Precipitation, as well, is directly influenced by climate change, as heating leads to surface drying and droughts, and intense interrupted precipitation events 'it never rains but it pours!' (Trenberth, 2011).

Regions of high population growth are believed to be high urban heat island areas; hence Middle East countries are potential regions for a higher influence of climate change (McCarthy et al., 2010). Palestine, like many countries around the world, faces imbalance in the climatic conditions resulting in unusual phenomena such as heat stress, destructive winds, dense precipitation, and drought. Studies show that, in the last 100 years, Mediterranean area has witnessed an increase in the average temperature by 1.5–4 °C, with a prediction of 4-6 °C further increase during 2071–2100 over the Palestinian territories. Precipitation in the same area shows a continuous negative trend in the last 50 years (Alpert et al., 2008).

Upon Oxfam (2020), some of climate change effects on agriculture in the Gaza Strip include: increasing temperatures and heat waves leading to reduced fruit production, the spread of diseases and pests due to higher temperatures and humidity, and the loss of crops due to strong and hot winds, drought, soil salinity, and the inability of plants to flower due to extreme cold.

1.2 Problem statement

The Islamic Resistance Movement, Hamas, is perceived as the biggest spoiler of Palestinian–Israeli peace. Rejecting the Oslo Accords, the extremist movement has engaged in numerous attacks against Israel. Historically emerged from to the Egyptian Muslim Brotherhood (Ekhwan), Hamas is classified as a terrorist organization by most of Western states, which marginalized it as a non-legitimate political force. Hamas was elected during the Palestinian elections of 2006 and has gripped power in the Gaza Strip after defeating Fatah (preceding party in power and the establisher of the Palestinian National Authority after Oslo Accords) in a military confrontation/coup in June 2007 (Bröning, 2013). Since then, Gaza Strip was placed under blockade by both the Palestinian Authority and Israel (East), Egypt (South), and Israel (West and North).

Blockade has always characterized Gaza's political economy under Hamas, with a continuous decline of Gaza's private sector, a rise of a private sector led by Hamas for serving party agenda, not national agenda, and imbalanced structure of political and economic dynamics (Tannira, 2021).

In his article 'The implications of siege and the internal Palestinian division on the situation in the Gaza Strip since 2007', Shaban (2017) summarizes the socioeconomic and political situation in the Gaza Strip after 2007 as follows:

- Three conflicts (now four after the 2021 conflict), leading to thousands dead and destroyed infrastructure and production facilities.
- Unprecedented level of unemployment (45%) of which 60% is in the youth sector.
- 80% of Gazan population live on food packages provided by UNRWA and other international organizations.

- Poverty rate has touched 48%, with extreme poverty cases of 21%, and absence of food security for 57%.
- Socially, since 2007, Gaza has been witnessing high rates of immigration, extremism, level of crime, social isolation, child labour, divorce, and violence against women.

Kurz et al. (2018) compares GDP/capita in Gaza with GDP/capita in the West Bank since 2005, (figure 1-2). While GDP/capita in the West Bank kept rising all the period, Gaza GDP/capita fluctuated. Between 2005 and 2008 it dropped sharply (the period of elections, political changes, and coup of Hamas). After a slight economic rise in 2008, following 2014 conflict, GDP dropped again. The same study states that GDP per capita in Gaza was $1,700 in 2015, while GDP/capita in the West Bank in 2015 was $3,700.

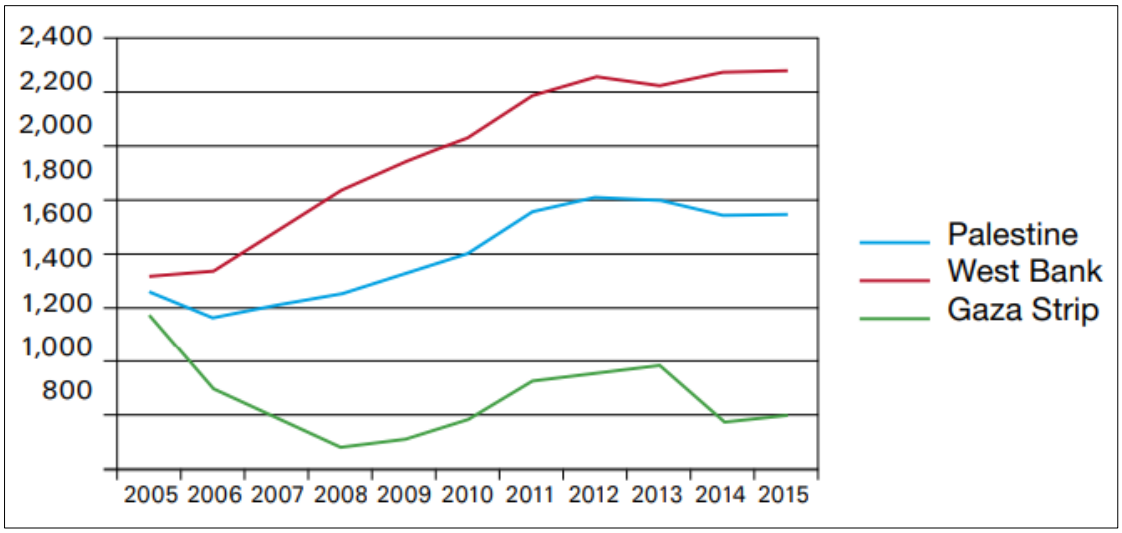

Figure 1-1: GDP per capita in Palestine (2005-2015)

This socioeconomic and political situation has affected all life affairs of Palestinians in the Gaza Strip. The overall impact on livelihood is likely to extend to agriculture, one of the most important contributors to the Palestinian economy and national income. Agriculture, which provides jobs to around 30,000 workers and food and livelihood to 25% of the population, suffer from huge damage of agricultural crops due to ban on agricultural medications, fertilizers, and supplies (Shaban, 2017). In contrast to the assumption that adapting to climate change hazards is commonly understood as a purely technical matter, Mason et al. (2012) argue that Palestinian climate is exacerbated by political situation, especially occupation and conflict, emphasizing as well on the role of social, economic, and political conditions in shaping Palestinians' responses to climate change.
Regarding adaptation to climate change, the Middle East in general is among the most fragile regions. Water is the main issue that may be affected by climate change in the Palestinian territories, a problem that could be partially adapted with using sea water desalination (Feitelson, 2012). The problem of water scarcity is most complex in the Gaza Strip amongst Palestinian territories, due to high dependency on rainfall irrigation (Abu Ormar and Abu Qauod, 2013).

The Palestinian farmer, under both deteriorating political and socioeconomic situation and harsh attack of climate changes is expected to be highly vulnerable. This should place adaptive capacity of farmers in the Gaza Strip under investigation for checking to what extent this sector of population can adapt to these general conditions.

The influence of surrounding conditions on adaptive capacity to climate change of farmers in Gaza is to be tested in this research. Measuring this influence could help in diagnosing specific parts of influence and comparing which dimensions have the highest/lowest influence. The study will, moreover, focus on specific components of climate change, those reported as most influential based on climatological data and focus group conducted during research process.

Eventually, the United Nations Development Programme (2010) state that a precautionary approach should be used in improving adaptive capacity in the Palestinian territories even if long-term climate trends are less harmful than predicted. This is an evidence that this research aligns with contextual problems and real needs of the community under study.

1.3 Research objectives

- To investigate most influential and tangible climate change components in the Gaza Strip, especially those with highest effect on agriculture.
- To measure the influence of socio-political status in Gaza and socioeconomic conditions of farmers in the Gaza Strip on their adaptive capacity to climate change.

1.4 Research question

To what extent do political and socioeconomic statuses affect the level of adaptive capacity to climate change among Palestinian farmers in the Gaza Strip? (with specific focus on heat stress and fluctuation of precipitation).

Sub-questions

1. What are the most influencing long-term climate change effects in the Gaza Strip, upon literature and Climate Data Store (CDS) models?
2. To what extent does socioeconomic status influence adaptive capacity to climate change of farmers in Gaza?
3. To what extent does socio-political status (political turbulence and repeated armed conflicts) influence adaptive capacity to climate change of farmers in Gaza?

1.5 Relevance of the study

While climate change is not taken very seriously by Palestinians in the West Bank and Gaza, the climate risks will compound, especially under occupation and political turbulence (Mason et al., 2012). The idea that climate change is not taken very seriously by Palestinians supports the argument that very limited literature is found discussing climate change in Palestine, especially those investigating adaptive capacity.

Many human rights violations were perpetrated by the Hamas authority in Gaza being unconnected to external pressure, which appears to reflect a policy adopted by the Hamas authority (Mukhimer, 2013). This includes right of opinion and research, which could be proved by the experience of gathering data for this research, where many obstacles were faced, investigations were done, meetings were conducted for issuing permission for conducting survey. This contributes to limiting research in general, and adaptive capacity research (from political and socioeconomic perspectives) in particular.

Few studies tackled the case of farmers in Gaza under climate change, such as (El-Nahhal, 2017), (Al-Smairy, 2020), (Mason, 2011), and (Ajjur, 2020). However, assessing the influence of socioeconomic and political status on farmers adaptability to climate change in Gaza is a new topic that was not discussed in deep before.

Chapter 2. Literature review

2.1 Climate change

As a result of the current population boom, climate change impacts are growing more pronounced, affecting climatic conditions, health, the environment, and economics. (Allam et al., 2020).

Upon Intergovernmental Panel on Climate Change IPCC (2014: 120), climate change refers to "*a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer*."

The United Nation's Framework Convention on Climate Change (UNFCCC) (1994), however, defines climate change as "*a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere, and that is in addition to natural climate variability over comparable time periods*".

On the difference in definitions between IPCC and UNFCCC, Pielke (2005) argues that this could be due to intellectual reasons, or political reasons, (locates the problem in the domain of energy policy). Pielke (2005) argues that a change in sun intensity, for example, leading to a climate change would not be a "climate change" in UNFCCC definition.

Over the course of its history, climate change discourse has developed from a completely scientific concern into a "public agenda" (Ishaqur-Rahman, 2013).

Ishaqur-Rahman (2013) states that the discourse has firstly been triggered by the French mathematician and physician Jean Fourier in 1824. Fourier, in a published article tackled greenhouse effect. Another outstanding contribution appeared half a century later when Svante Arrhenius calculated the global wanning caused by human emissions of Co2.

Upon American Institute of Physics AIP (2022), it was not before 1970s that the "world public's climate anxieties were jumping higher as savage droughts and other weather disasters struck several important regions."

Emerging as a public issue, climate change has been addressed from political, social, and economic perspectives. Bulkeley and Betsill (2013) argue that 1990s witnessed early negotiations led by national governments, scientific community, and international organizations to address "set of debates that would become known as 'climate change'". Same article assumes that urban politics and agendas beyond technical/municipal responses have emerged to the arena of climate change studies and interventions.

Raleigh and Udrall (2007), however, assume that predicting how climate change could influence political systems embeds a very high uncertainty. Raleigh and Udrall, in the same article conclude that political and economic factors highly outweigh demographic factors when it is about climate change influence.

In the same vein, Gasper et al. (2011) highlight social and economic dimensions of climate change by arguing that interrelated social and economic climate change impacts are growing clearly in empirical research. For example, Hanif et al. (2010) in their paper (Economic impact of climate change on the agricultural sector of punjab) investigated and proved the relationship between climate change and the price of agricultural land in Punjab.

On a global level, Tol (2013) argues that climate change was beneficial for most countries until 1980, but it turned in the 21st century harmful (economically) "negative for poor countries and positive for rich countries". Tol emphasizes that negative economic impacts include energy demand and water resources.

To sum up, climate change has not been a topic of climatology or physics only, but has been a hot topic of research in human sciences as well. This is due to the indirect impact climate change leaves on economy, politics, and social life of human communities.

2.2 Adaptation to climate change

IPCC (2014) defines adaptation as "the process of adjustment to actual or expected climate and its effects." IPCC continues its definition by emphasizing that adaptation aims to "moderate or avoid harm or exploit beneficial opportunities." De Franca Doria et al. (2009) investigated the consensus on "successful adaptation" definition. They concluded that the following definition exceeded 80% consensus "Successful adaptation is any adjustment that reduces the risks associated with climate change, or vulnerability to climate change impacts, to a predetermined level, without compromising economic, social, and environmental sustainability." Integrated and compliant with this definition, comes IPCC report 18 on (Adaptation to climate change in the context of sustainable development and equity), in which it is argued that communities can autonomously adapt to climate change, but with cost damages.

Addressing socioeconomic dimension in a planning process that considers effectiveness, efficiency, equity, and legitimacy is important in judging level of sustainability of adaptation-related interventions (Adger, 2005). Dolšak and Prakash (2018) go further in this argument by tackling the political dimension as an important player in adaptation process. They emphasize that adaptation has something to do with issues of "power, conflicting policy preferences, resource allocation, and administrative tensions." In the same study, authors assume that international influences shape local adaptation policy. This ensures the realisticity of this study (thesis) as it handles political dimension as a major player in adaptation process.

Tanzler (2010), in the same vein, emphasizes that socio-political consequences of climate change can't be met using a purely technical understanding of adaptation. Adaptation approaches, consequently, should be designed to be conflict-sensitive, and to complement by development measures adopted and supported internationally.

However, Javeline (2014) argues that adaptation to climate change is not adequately studied by political scientists. In her article holding the title (The most important topic political scientists are not studying: adapting to climate change), Javeline emphasizes that one of the obstacles adapting to climate change is facing is the shortage of political science research and expertise in the field of adaptation to climate change. The author comes to a slogan-like idea by stating that "adaptation is fundamentally political". She explains by stating that technical adaptation advances in infrastructure, agriculture, and other fields all rely on political variables to be implemented effectively, a conclusion that matches Tanzler's (2010).

2.3 Adaptive capacity

Diving deep to the roots, vulnerability is known by IPCC (2014) to "encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt."
Hence, adaptive capacity is one of the components of vulnerability, referring to the ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences (IPCC, 2014).

The contribution of adaptive capacity to vulnerability is presented in two different ways in IPCC (2007) and IPCC (2014), as shown in figure 2-1 below (Sharma et al., 2019).

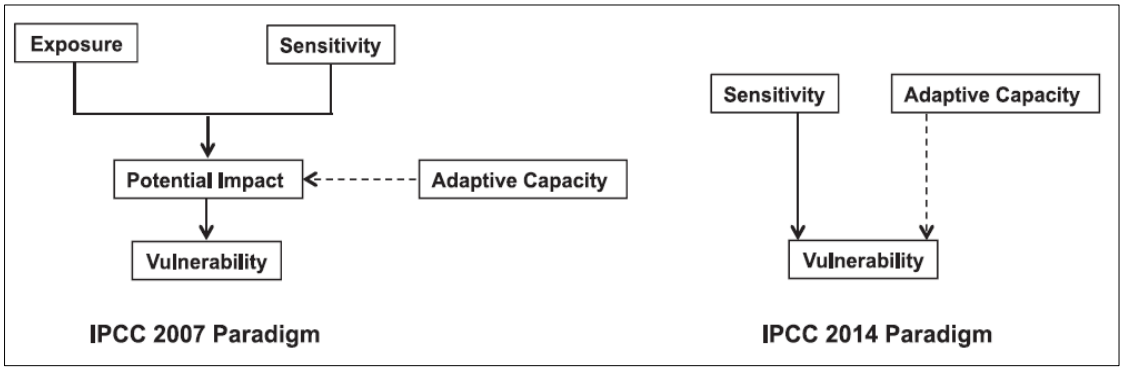

Figure 2-1: IPCC 2007 and 2014 concepts of vulnerability with adaptive capacity in different positions of effect

In 2007 paradigm, adaptive capacity interferes to 'negatively moderate' the exposure and sensitivity effect on vulnerability, i.e. adaptive capacity externally affects a system. On the other hand, in 2014 paradigm, adaptive capacity is an internal component of a system's vulnerability (working to reduce sensitivity effect). It could be inferred that 2014 paradigm intends to depict adaptive capacity as a 'built-in' component of a system, in a sign of the significance of adaptive capacity in determining the level of systems' resilience, and to encourage considering adaptive capacity a main pillar of a sustainable and resilient city/society.

Much research work has been conducted on assessing adaptive capacity. One of the most popular and concise studies on measuring adaptive capacity is that of Smit et al. (2001), where the following determinants have been used: economic resources, technology, information and skills, infrastructure, institutions, and equity. UN-Habitat (2014) further explained the determinants of Smit et al. (2001) generating a set of indicators for each determinant, including economic wellbeing, technology, infrastructure, information and skills, and institutions and social capital.
However, Hinkel (2011), upon reviewing plenty of research work on adaptive capacity assessment, assume that there is no consensus on indicators of adaptive capacity, bargaining that mechanisms causing harm are different from context to another.
Accordingly, Yohe et al. (2002) classifies adaptive capacity determinants into those that could operate on a macro-scale (national and regional), and those functioning on micro-scale (location-specific) (table 2-1).

Table 2-1: Yohe et al. (2002) classification of adaptive capacity determinants

Macro-scale determinants	Micro-scale determinants
• Macro-scale and international institutions • The stock of social capital • Efficacy of risk-spreading processes	• The set of available, applicable, and appropriate technological options • Resources • The stock of human capital • Managing information • Attributing signals of change to their sources

This context-related orientation of assessing adaptive capacity is touched in most of literature, where no common or fixed criteria of assessment is used. For example, Hogarth and Wójcik

(2016) use the following five elements to assess adaptive capacity in Jamaica: 1) asset base, 2) institutions, 3) knowledge and information, 4) innovation, and 5) flexible decision making and governance.
However, in another example from Asia (Thailand), Thanvisitthpon et al. (2020) used a six-indicator system for assessing adaptive capacity in Thailand by assessing 1) economic resources, 2) social capital, 3) awareness and training, 4) technology, 5) infrastructure, and 6) institutions and policies.
Although there is no unified assessment system, criteria used in different literature works is so close to each other. It could be concluded from reviewing literature above that specific components are common in all studies, such as information and awareness, technology, infrastructure, and governance (institutional system in some studies).

2.4Climate change – contextual overview

The Middle East rapid urbanization raised the importance of addressing vulnerabilities caused by climate change, where temperature rise and changes in the precipitation patterns are major impacts (Salimi, 2020). A parametric statistical analysis of annual rainfall in Israel/Palestine over a period of 60 years shows significant changes in the shape and scale of rain patterns (Ben-Gai et al., 1998).

Black (2009), in a study using a regional climate model that investigated changes in precipitation of Israel and Jordan at the end of the 21st century, predicts that this region will become significantly drier at the peak of the rainy seasons, reflecting drop in both the frequency and duration of rainy events. While in Evans (2009) there is evidence of a decrease of over 170,000 km2 in rain-fed agriculture land in Israel/Palestine, Lebanon, Syria, Iraq, and Iran.

Albaba (2018) concludes in his article on climate change impacts on crop production in Palestine, that both summer and winter seasons are warmer at the present time (2007-2017) than 20 years ago. Albaba's study also shows a significant "reduction and fluctuation" in precipitation considering the said period in comparison to the past. The impact of these climate changes directly affected agriculture in Palestine generally and in the Gaza Strip specifically, posing a direct threat to food security.

Figure 2-1 shows a historical rainfall statistic (2001-2009) prepared by Geographic Information Systems and Remote Sensing Unit of the Applied Research Institute (ARIJ) (2009). It is clearly read in this figure to what extent rainfall amount is sharply dropping by time in the Palestinian territories, especially in Gaza.

By considering the special case of Palestinian Israeli conflict lasting for more than 70 years up to now, Feitelson (2012) argues that potential implications of climate change are highly influenced by conflict. Feitelson (2012) emphasizes that the conflict in this area makes water the main issue to be affected, subjecting ‘peripheral farmers’ to higher vulnerability and less adaptability, which in turn could root conflict by pushing the two sides to “rigidify their negotiating positions.”

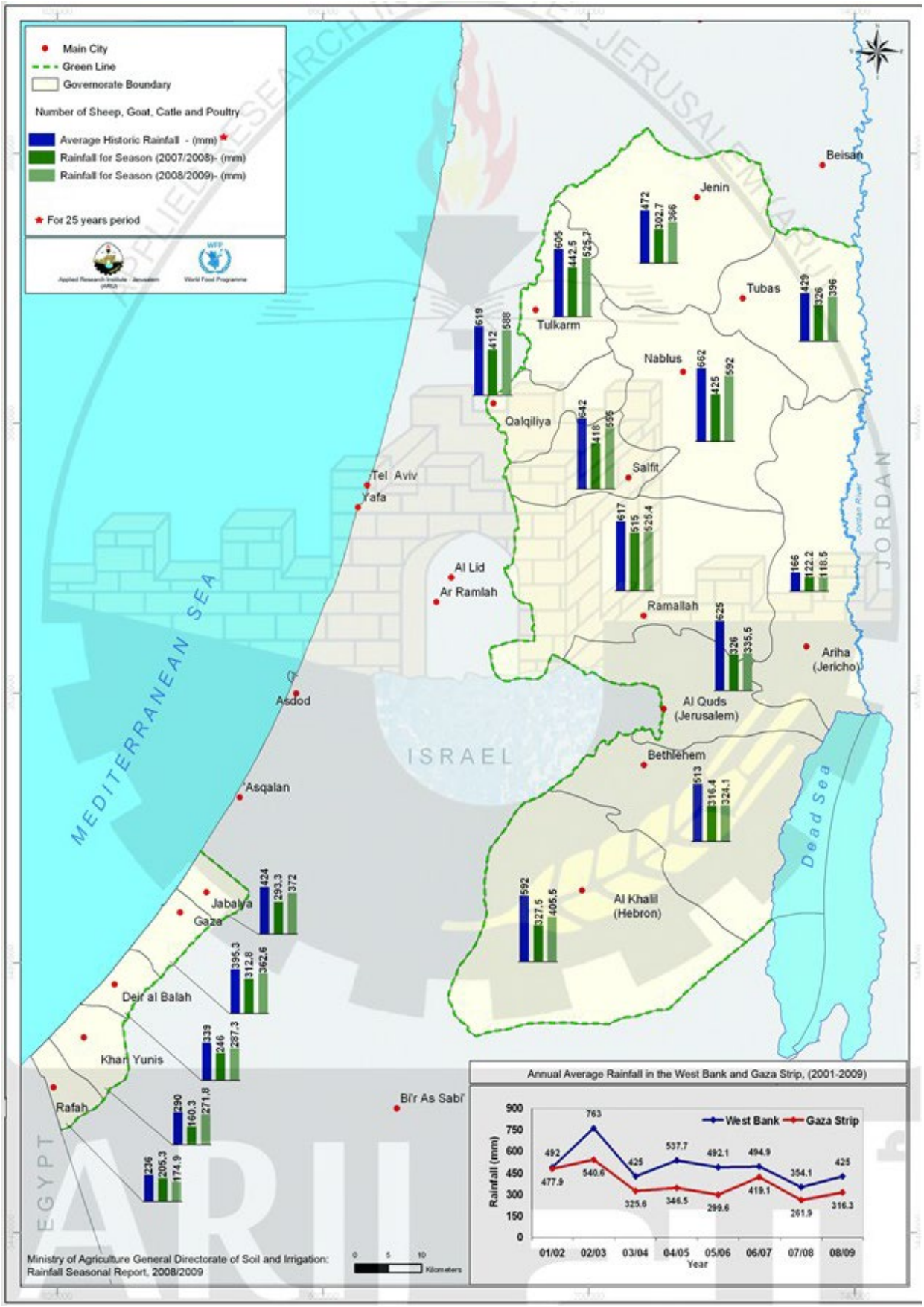

Figure 2-2: Historical rainfall statistic (2001-2009) - Palestine

In the case of Gaza, as well as anywhere in the world, heat stress could increase the risk of conflict, since higher temperature leads to droughts and shortage of water, resulting in crop failure (Ide et al., 2016). Vulnerabilities due to conflict extend to women working and living in agricultural zones in Gaza, a fact revealed by Al-Smairy (2020) in her master's thesis addressing 'the impact of accumulation of vulnerability among women in Khuzaa on their resilience in the aftermath of 2014 Israeli aggression on Gaza Strip'. Al-Smairy concludes the following drops in resilience indices of women in Khuzaa area (one of the most important agricultural baskets of Gaza) (table 2-2):

Table 2-2: Al-Smairy resilience indices of women in Khuzaa area - Gaza

Resilience Index	Before conflict	After conflict
Economic resilience	0.482	0.433
Infrastructure resilience	0.889	0.742
Physical resilience	0.865	0.827
Social resilience	0.679	0.621

Brück (2019: 1) confirms this conflict-caused deterioration by concluding that the majority of the damages in the Gaza Strip due to 2014 conflict was in areas close to the Israeli border. Brück argues that "household resilience capacity that is necessary to resist food insecurity declined among Gazan households as a result of the conflict. This was mainly due to a reduction of adaptive capacity, driven by the deterioration of income stability and income diversification."

The instable political situation together with other factors led to deterioration of economy as well. In mid-2007, around 70% of the industrial sector was terminated, however pollution increased due to the lack of technologies and wastewater treatment facilities. This makes population growth rate in Gaza one of the highest in the world (Shomar, 2011).

Under a deteriorated economic status, Gaza farmers, who irrigate crops by brackish water due to scarcity of water, sea intrusion, and other reasons, are prevented from reaching export markets or having the knowledge of climate-change projections. Furthermore, over a third of arable land in Gaza is not accessible by farmers as it falls within areas declared by Israel as "no-go" and "high-risk" zones (lands close to border with Israel) (Mason, et al., 2011)

Adaptation should be conceptualized as a matter of politics, since it is associated to issues of conflicting preferences, power tensions, and resource allocation (Dolšak et al., 2018). Climate change in the Gaza Strip, especially under the above-detailed economic and political situations can't be separated from its context. Socioeconomic and socio-political situations are major contributors of shaping climate change response and adaptive capacity in Gaza. This emphasizes the importance of addressing and measuring the influence of socioeconomic and socio-political status on the level of adaptive capacity of people in Gaza in general, and farmers in particular.

2.5 Socioeconomic and socio-political statuses

Climate change is a complex problem that is influenced by a wide range of factors. In their study tackling impacts of climate change in Palestine, Mason et al. (2012: 40) argue that "climate vulnerability is less about changes in physical systems than the political-economic contexts". Climate Change adaptation in Palestine is not merely a technical challenge; rather, it is a socio-political mission that is highly linked to region-specific social and geopolitical vulnerabilities (Jarrar, 2015). Sharma et al. (2019) simplify where and how adaptive capacity

(as a human factor) influences vulnerability (figure 2-2). As socioeconomic and socio-political factors are human factors, it is presumed that there is a relationship between socioeconomic and socio-political factors and adaptive capacity of farmers in the Gaza Strip.

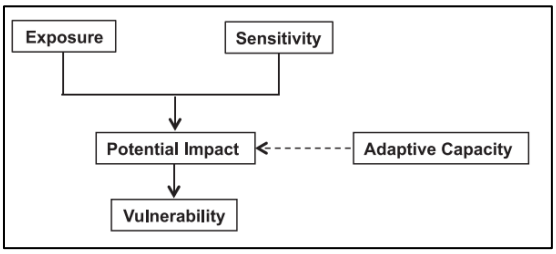

Figure 2-3: IPCC (2007) frameworks on vulnerability to climate change by Sharma et al. (2019)

2.5.1 Socioeconomic factors

Socioeconomic position refers to the social and economic factors affecting individuals' positions within the structure of a society (Galobardes, et al., 2006). Baker (2014), however, argues that socioeconomic status is assessed by combining education, income, and occupation. Mogaka et al. (2021) defined seven socioeconomic indicators that can be used in farming-related assessments, namely age, gender, education level, farming experience, farm size, credit use, and land tenure system. Jimoh et al. (2021) added other factors related to vulnerability in general, of which the following were selected as related to socioeconomic status of farmers: disabilities, marital status, employment status, income, insurance coverage, participation in training on climate change adaptation, and support from community and relatives.
Anyoha et al. (2013) added (family size) and (membership of social organization) to the indicators that could assess socioeconomic status, specifically of farmers.

2.5.2 Socio-political factors

In their study on the effect of socio-political and socioeconomic factors on environmental sustainability, Mukherjee and Chakraborty (2013) argue that socio-political factors can include level of corruption and ability to exercise democratic rights. However, the current political situation in the Gaza Strip (after 2007 coup leading to the control of Islamist de facto government of Hamas on the strip) makes it very vague and complex to assess democracy and corruption. Furthermore, no election took place in Gaza since 2007, which gives a clear indication on the status of democracy and corruption and makes it useless to place these factors under test.
A series of socio-political indicators were discussed by Ibrahim et al. (2021) who addressed socio-political status from a different perspective, for example: decentralization of water resources, water security, political stability, employment, etc.
In this thesis, some of the factors set by Ibrahim et al. will be adopted for the following reasons:

- Enumerated factors matter to socio-political life, especially in developing societies where those factors might be construed as root causes of socio-political status, given that democracy and low corruption (major indicators of socio-political status) are assumed to be absent from the whole political scene in Gaza.
- Ibrahim et al. selected this list of factors considering the (adoption and proliferation of desalination) as a dependent variable. This is close to this thesis question in the sense that (adoption and proliferation of desalination) is -to some extent- equivalent to adopting adaptation to climate change as a strategy towards more resilient and less vulnerable agriculture. Consequently, this strengthens the rationale of using same list of socio-political factors in this thesis.

Chapter 3. Research design, methodology

3.1 Research Strategy and Type

This research investigates socioeconomic and socio-political factors influencing adaptive capacity to climate change of farmers in Gaza. For this, the researcher used descriptive analytical approach. This is a deductive research that starts from a hypnotized influence of socioeconomic and socio-political status on the adaptive capacity to climate change among Palestinian farmers in Gaza (Mason et al., 2012), (Jarrar, 2015), and (Adger, 2005). A mixed method was used to answer research questions. This included desk research, focus groups, interviews, and survey.

To measure the relationship between concepts, a survey has been designed based on operationalization table provided below. The survey targets farmers all over the Gaza Strip to assess the influence under study. Before that, a desk research had been conducted to analyse most influential long-term climate change components in the Gaza Strip, after which the study has been focused on measuring adaptive capacity to this component specifically. Desk research depended on data from Climate Data Store models. Interviews and focus groups followed desk research and aimed to assessing and approving questionnaire and gaining more information regarding socioeconomic status of farmers in Gaza, respectively.

3.2 Data triangulation and research method

To achieve highest possible level of accuracy, reliability and causality, triangulation of data sources is used as follows:

- Identifying most influential climate change component: Data are gathered from 1) Climate Data Store (desk research), 2) literature (less dependency of literature due to shortage of context-related data), and 3) focus groups with farmers.
- Socioeconomic status of farmers: Data are gathered mainly using survey and triangulated using focus groups. Literature contributed more in this part, as the socioeconomic and political statuses of Gaza were studied before, however much of these studies tackle socioeconomic status of Gazans in general (not farmers particularly).
- Adaptive capacity: Data are collected mainly using survey. Literature doesn't provide much studies in this part. Focus group could help in a minimum level, as the farmers themselves are not much aware of adaptive capacity techniques and necessity.
- Assessing and approving questionnaire: This step of survey design included conducting interviews with two local academic experts to assess the questionnaire's validity to measure research questions. Literature contributed in this part by guiding the process of building valid and reliable questionnaire and testing and analysing it later.

Figure 3-1 below explains how tools were used to gather data regarding different parts of the study.

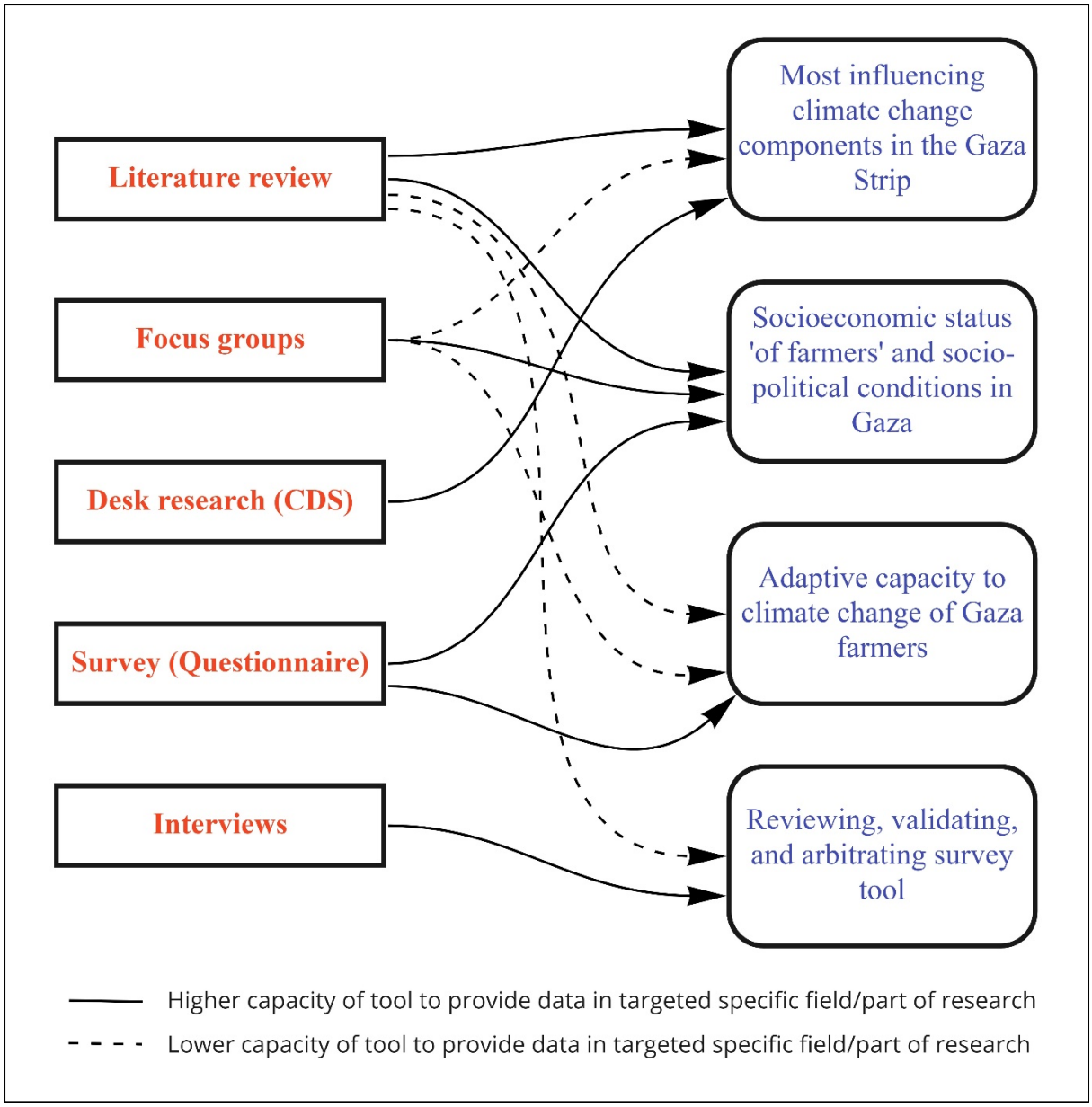

Figure 3-1: Data triangulation

3.3Conceptual framework

Climate change is a complex problem that is influenced by a wide range of factors. In their study tackling impacts of climate change in Palestine, Mason et al. (2012: 40) argue that "climate vulnerability is less about changes in physical systems than the political-economic contexts". Climate Change adaptation in Palestine is not merely a technical challenge; rather, it is a socio-political mission that is highly linked to region-specific social and geopolitical vulnerabilities (Jarrar, 2015). Sharma et al. (2019) simplify where and how adaptive capacity (as a human socio-economic and political factor) influences vulnerability (Figure 2-2).
Considering the arguments of Jarrar (2015) and Mason et al. (2012) about Palestinian context, it is assumed that socioeconomic and political factors have an influence on adaptive capacity to climate change in the Palestinian territories.

This is inspired by the fact that Gaza is politically 'hot' area where climate change adaptation "is a socio-political mission" (Jarrar, 2015). Together with politics, socioeconomic factors work thereafter to shape the adaptive capability of farmers in Gaza.

Considering the above debate, this thesis focuses on adaptive capacity of IPCC (2007) framework (figure 2-1) and tries to investigate the influence of human/societal factors (socioeconomic and socio-political) on adaptive capacity of farmers in the Gaza Strip (under heat rise and rainfall scarcity as climate change components highly manifesting in Gaza) (Figure 3-2).

The variables used in the study are:

- Socioeconomic status: Independent variable
- Political status: Independent variable
- Adaptive capacity to climate change among Palestinian farmers in the Gaza Strip: Dependent variable

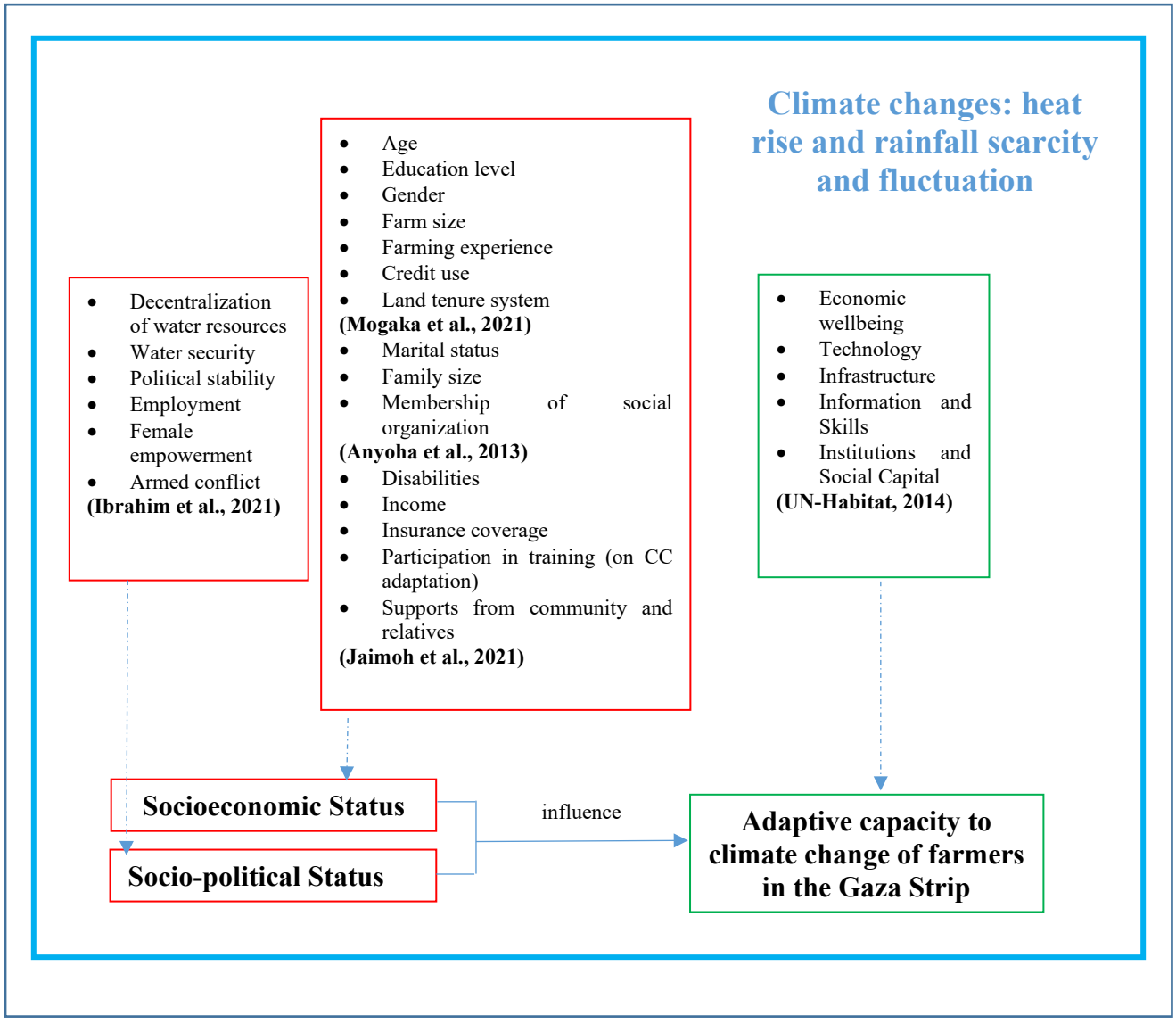

Figure 3-2: Hypothesized conceptual framework of socio-political and socioeconomic statuses

3.4Operationalization table

Table 3-1: Operationalization table

Concept	variable	Indicators	Scale
Socioeconomic factors affecting adaptive capacity to climate change (**Independent variable**)	Personal characteristics	Age (Mogaka et al., 2021)	age of farmer in years (continuous)
		Gender (Mogaka et al., 2021)	female = 1, male = 2 (categorical)
		Marital status (Jaimoh et al., 2021)	married = 1, single = 2 (categorical)
		Family size (Anyoha et al., 2013)	number of farmer's dependents (continuous)
		Disabilities (Jaimoh et al., 2021)	yes = 1, no = 2 (categorical)
	Education and awareness	Education level (Mogaka et al., 2021)	primary = 1, secondary = 2, tertiary = 3 (categorical)
		Number of training courses on adaptation and climate change (Jaimoh et al., 2021)	number of training courses a farmer has attended (continuous)
		Farming experience (Mogaka et al., 2021)	number of years a farmer has worked in farming (continuous)
	Socioeconomic strengths	Income (Jaimoh et al., 2021)	monthly income in NIS (less than 1000, 1000-2000, more than 2000) (categorial)
		Employment status (Jaimoh et al., 2021)	number of employed persons in a farmer's household (continuous)
		Insurance coverage (Jaimoh et al., 2021)	yes = 1, no = 2 (categorical)
		Credit use (Mogaka et al., 2021)	yes = 1, no = 2 (categorical)
		Land tenure (owned or rented) (Mogaka et al., 2021)	owned = 1, rented = 2 (categorical)
		Farm size (Mogaka et al., 2021)	total size of farmland in donums (continuous)
		Membership of social organization (Anyoha et al., 2013)	yes = 1, no = 2 (categorical)
		Support from community and relatives (Jaimoh et al., 2021)	yes = 1, no = 2 (categorical)
Socio-political factors affecting adaptive capacity to climate change (**Independent variable**)	Water security	Decentralization of water resources: if freshwater can be generated locally instead of being supplied exclusively from a central, remote source (Ibrahim et al., 2021)	Distance from farmland to water source (less than 50m, 50-150, more than 150m) (categorial)
		Decentralization of water resources: Water source for irrigation	1 = municipal, 2 = wells, 3 = rain, 4 = treated wastewater,

			or 5 =buying water (categorial).
		Water quality (Tu et al., 2021)	Scale (1-5)
	Political stability (Ibrahim et al., 2021) (Conflicts effect)	Level of farmers' acceptance regarding governmental arrangements (Ibrahim et al., 2021)	Scale (1-5)
		Proximity of farm to conflict points (Israeli border)	less than 500m, 500-1000, more than 1000m) (categorial)
		Total economic losses due to conflicts in Gaza (2008-2021)	Total losses in NIS (less than 10,000, 10,000-20,000, more than 20,000) (categorial)
	Female empowerment (Ibrahim et al., 2021)	Percentage of women practicing in agricultural work (Klasen, 2007)	Number of women working in farm (continuous)
Adaptive capacity to climate change (**Dependent variable**) (Likert scale)	Economic wellbeing	Access to adequate financial resources (UN-Habitat, 2014)	Scale (1-5)
		Availability of resources to respond to a climate-related hazard (UN-Habitat, 2014)	Scale (1-5)
	Technology	Ability to communicate directly with the people/sector during hazard (e.g. basic communication infrastructure) (UN-Habitat, 2014)	Scale (1-5)
	Infrastructure	Adequate transport, water infrastructure, sanitation, energy supply and management (UN-Habitat, 2014)	Scale (1-5)
		Access to safe, clean drinking water in the event of a hazard occurrence (UN-Habitat, 2014)	Scale (1-5)
		Adequate medical services in close proximity (UN-Habitat, 2014)	Scale (1-5)
	Information and Skills	To what extent decision-makers are aware of a) climate change and b) potential impacts/risks (in farmer's jurisdiction) (UN-Habitat, 2014)	Scale (1-5)
		Level of awareness regarding current and/or potential impacts of climate change (training courses and workshops attendance level) (UN-Habitat, 2014)	number of training courses a farmer has attended on AC/CC (continuous)
		Training on emergency response (UN-Habitat, 2014)	number of training courses a farmer has attended on emergency response (continuous)
	Institutions and Social Capital	To what extent there is political willingness to allocate resources to build adaptive capacity (UN-Habitat, 2014)	Scale (1-5)

		Level of community/neighbourhood "leaders" intervention to quickly organize people in the event of a hazard occurrence (UN-Habitat, 2014)	Scale (1-5)
		Level of integration/involvement in designing adaptation processes (UN-Habitat, 2014)	Scale (1-5)
		Availability of existing plans, including emergency response plans (to the best knowledge of farmer) (UN-Habitat, 2014)	Scale (1-5)
		Availability of specific agencies, community groups, and/or NGOs that have the mandate and skills to focus on the specific sector/area? (UN-Habitat, 2014)	Scale (1-5)

3.5 Methods selected for this research

In addition to deeply reviewing literature, four different research methods (mixed method) are used, namely desk research, focus groups, interviews, and survey. Survey using questionnaire is the major method in this study, while other methods are supportive.

3.5.1 Focus groups

Two focus groups were held with farmers from Southern and Northern areas of the Gaza Strip, in which about 10-15 farmers participated in each. The researcher first introduced research idea and importance, explained what is meant by climate changes and their being under focus globally, and oriented the discussion towards answering major three questions below:

- Based on your experience, what climate changes have you been noticing in the last few years compared to the past? And how this affected your agricultural production?
- What basic needs do you think that farmers are lacking in their family and farming lives to be more adaptive to climate changes? For example, financial needs? security? access to credit? water security?
- What techniques do you apply in your farming activities to adapt to climate changes, especially those you see as highly influential?

The focus groups (Figure 3-3) in South and North lasted for two hours and one hour and 20 minutes respectively.

Figure 3-3: Focus groups arranged and managed by the researcher in the Gaza Strip governorates

3.5.2 Desk research

To begin with, the researcher opted to define the climate change components that could be of highest tangibility in the Palestinian territories in general and in the Gaza Strip in particular. Climate Data Store analysis was conducted using data for 40 years (1980-2020) to check literature argument that rise in temperature and scarcity and fluctuation of rain have been clearly noticed in the Palestinian territories in the last decades (Alpert et al., 2008), (Mimi, 2010), (Salimi, 2020), (Ben-Gai et al., 1998), (Black, 2009), and (Albaba, 2018).

3.5.3 Questionnaire

A questionnaire is a document designed with the purpose of seeking specific information from the respondents (Sansoni, 2011).

In this research, questionnaire is used to measure the influence of socioeconomic status and political situation (including armed conflict in Gaza) on adaptive capacity to climate change (heat stress and rainfall fluctuation) of Palestinian farmers in the Gaza Strip. The questionnaire is divided into three parts:

- Part I: Socioeconomic status (independent variable), including three sub-parts: general information (age, gender, etc.), level of education and awareness of climate change, and socioeconomic strengths (income, access to credit, land ownership, etc.) (Mogaka et al., 2021), (Anyoha et al., 2013), and (Jimoh et al., 2021).
- Part II: Political situation and armed conflict (independent variable), including water security, political stability (Ibrahim et al., 2021), and female empowerment (Klasen, 2007).
- Part III: Adaptive capacity (independent variable), including economic wellbeing, technology, infrastructure, information and skills, and institutions and social capital (UN-Habitat, 2014).

3.5.3.1Sample

The targeted population is the farmers of the Gaza Strip who are estimated in 2021 as 15,600 capita (Palestinian news and info agency, 2022). A sample of 375 persons were selected randomly to participate in the survey, based on Thompson (2012) formula below:

$$n = \frac{N \times p(1-p)}{[(N-1) \times (d^2 \div z^2)] + p(1-p)}$$

Where,
n: sample size
N: population size
Z: confidence level
d: margin of error
p: population proportion

Using 15,600 population size, a 95% confidence interval, a 5% margin of error, and a 50% population proportion, sample size would be 375 participants (Sample size calculator, 2022), (Figure 3-4-a).
About 400 questionnaires were distributed on farmers from the five governorates of Gaza. 335 valid questionnaires were collected back. The proportion of response out of the required sample size (375) is then 89.33%. A sample size of 335 raises the margin of error to 5.3% instead of 5% (Figure 3-4-b)

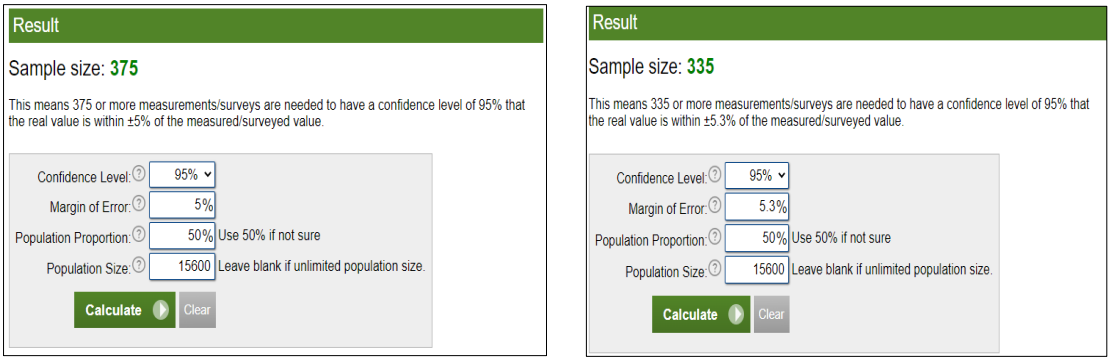

Figure 3-4-a: sample size calculator at margin of error 5% b: sample size calculator at margin of error 5.3%

3.5.3.2 Validity and consistency of the Questionnaire

Arbitrators validity

Before conducting survey in field, two expert arbitrators are asked to comment on the questionnaire with respect to appropriateness of phrases to measure relationships between variables, clarity of statements, how suitable each statement is for the area it belongs to, and the general sufficiency of statements to cover all research subjects.

Internal Validity

Internal validity measures if the tool of research measures what it really intends to measure, wither variables are well operationalized, and if there are casual relationships between variables or not (Van Thiel, 2014). To achieve a high level of internal validity, the researcher intended to triangulate data sources. Firstly, desk research was done to check most influential climate changes in the Gaza Strip, and literature was deeply navigated to investigate adaptive capacity of farmers in Gaza and the effect of socioeconomic and political situation on their adaptive capacity. Secondly, two focus groups were arranged to check desk research and literature review outcomes. Finally, questionnaire was designed in the light of the two previous tools for checking the whole results.

Moreover, a **Pearson correlation** coefficient was used to measure the internal consistency of questionnaire items. Pearson Correlation measures the relationship between paragraphs in one field and the entire field (Taylor, 1990).

External validity

External validity is the generalizability of results, it checks wither a causal relationship applies when persons, settings or other conditions are different (Shadish, 2002). However, the case of Gaza farmers makes it difficult and uncertain to judge if external validity of any study could be fulfilled. The complex situation explained in previous chapters, including the unique political and economic situation makes this case unique and very uncertain for any research results to be generalized.

3.5.3.3 Reliability of the Questionnaire:

Reliability of research measures if the researchers can get similar results if research is repeat under same conditions (Singh, 2017). Cronbach's alpha coefficient for the reliability measurement has been used to assess reliability of the questionnaire.

3.5.3.4 Normal distribution test: Kolmogorov - Samarnov test

Kolmogorov - Samarnov test is used in this research to check if the data follow a normal distribution or not (Berger and Zhou, 2014).

5.5.3.5 T- test and One-way ANOVA tests:

These tests were used in this study to measure the difference between a paragraph's mean and medium neutral (Rice, 1989).

3.5.4 Interviews

Two local academic experts were interviewed to assess the questionnaire's validity to measure research questions. An interview with officers of local authority was conducted to explain questionnaire content and gain approval for using it as a research tool.

3.6 Limitations to data collection

- The questionnaire of the study went into deep and lengthy security check by De facto government of (Hamas) controlling Gaza. This caused delay in conducting the questionnaire, and led to omitting some questions, especially some of these related to socio-political situation. Security officers insisted on excluding some of the questionnaire parts, for example, a part investigating the distance between farmlands and the Israeli fence. This question was assumed to measure the relationship between adaptive capacity of farmers and the proximity of fence (a zone called No-go, referred to in Mason, et al. (2011)), where farmers risk their lives to reach in order to practice their daily farming duties. To cover this shortage, the researcher did the following:
    - Some questions were re-written to avoid some words or phrases that could intersect security-related issues.
    - The data of proximity to fence were collected indirectly, by limiting the question to a sample of respondents who could be accessed verbally, and by reaching several senior farmers in the five governorates by phone to get estimated answers.
- The farmers of the Gaza Strip are scattered in the five governorates, and most of their farms and houses are located in marginalized and remote areas. This made it complex to reach them, adding to this the timing they could be available in, mainly very early in the morning (around 06:00). To meet this time and geography constraints, the researcher had to visit each governorate twice or more sometimes to ensure meeting the maximum number of farmers, which consumed long time and relatively high transport expenses.
- In some regions, especially in the northern and middle governorates of the Gaza Strip, it is hard to meet female farmers or explain questionnaire content to them (due to certain cultural and religion-related limitations, which is relatively different in Gaza-city and Southern governorates). For investigating female participation and empowerment to the best level possible, the researcher had to explain questionnaire content to educated male persons from the families of the female farmers, so that the male mediators explain the questions to their sisters, mothers or wives in order for them to fill questionnaires.

Chapter 4. Results, analysis, and discussion

4.1 Research geographic area

The Gaza Strip is a Palestinian entity about 28 miles (45 km) long and 5 miles (8km) wide, encompassing an area of 140 square miles (363 square km) (Roy, 1987). The Gaza Strip is located in between longitudes 34° 13″ and 34° 34″ east, and latitudes 31°13″ and 31°35″ North (Ajjur and Riffi, 2020).

Gaza population in 2022 has reached 2,166,269 capita distributed on five governorates (figure 4-1) (Palestinian Central Bureau of Statistics PCBS, 2022).

Upon data above, the density of Gaza population is about 5935 capita/square km, making it "equivalent to that of Hong Kong and among the highest in the world" (Roy, 1987: 58).

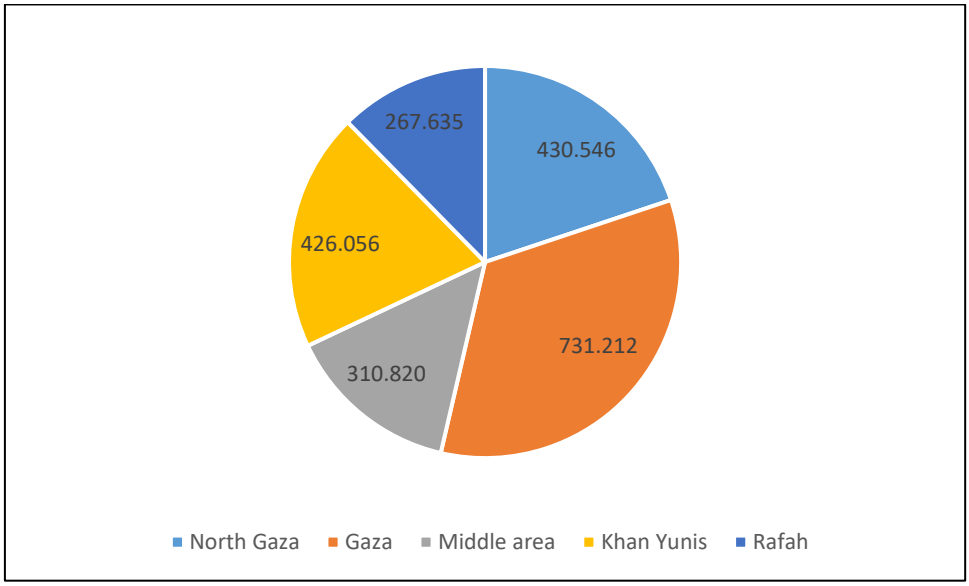

Figure 4-1: Gaza Strip population 2022 by governorate

As shown in figure 4-2 below (Geographic Information Systems and Remote Sensing Unit of the Applied Research Institute – Jerusalem (ARIJ), 2022), the Gaza Strip is surrounded by the Mediterranean sea from west, Egypt from South, and Israel from north and east. The figure shows that the border with Israel is occupied by a wide security zone. One of the objectives of this study is to investigate the effect of proximity to security zone and Israeli border on farmers' adaptive capacity, knowing that this area is subject to frequent destruction during armed conflicts between Israeli forces and Palestinian armed troops.

Smith and Isleem (2017) call this security zone a 'no-go Zone' and say that it takes 30% of the total arable land in Gaza as part of a larger siege on Gaza. This zone creates great difficulty for farmers who risk their lives in "attempt to support the nutritional needs of the population of the territory", which contributes to undermining "independent development and food sustainability within the Gaza Strip." (Smith and Isleem 2017: 1)

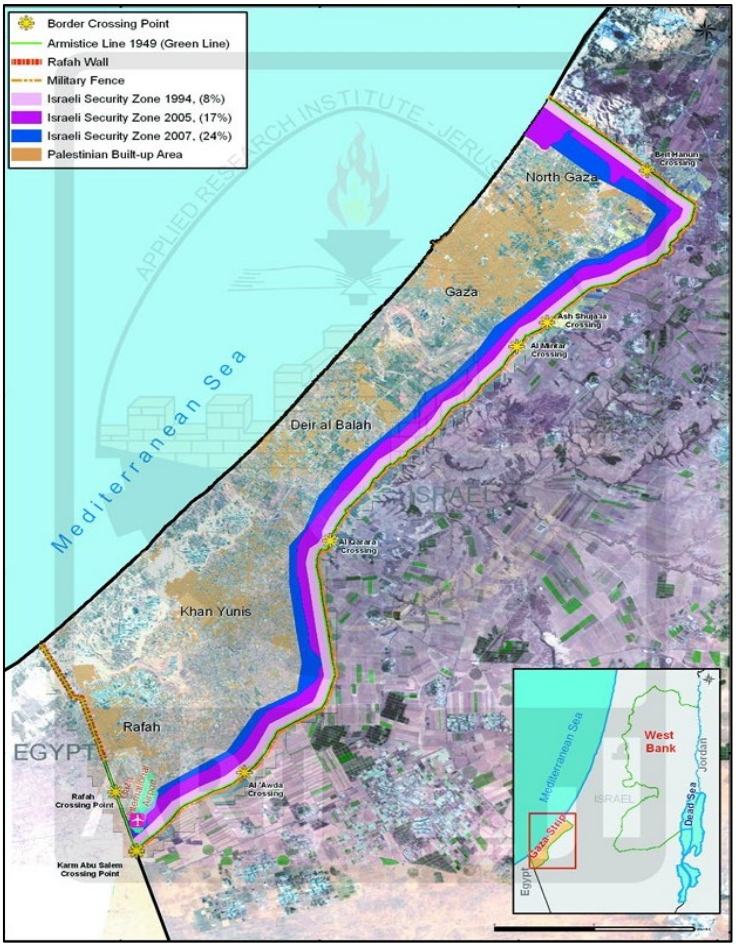

Figure 4-2: Gaza Strip borders and the no-go zone

4.2 Desk research results

Climate Data Store (CDS) was used to analyse historical climate data over 40 years. EAR5 climatological data were used in analysis. Upon literature review and focus group, temperature rise, and rain decrease are believed to be the most tangible two climate-change components in Gaza. This part of study will investigate this through modelling.

The analysis of temperature change over 40 years in Gaza was run using three-year intervals (1980, 1983, 1986, …., 2020), while rainfall analysis was run for every year in the period under study (1980-2020).

For analysing heat effect, the data of three summer months in Gaza (June, July, and August) were used. On the other hand, the data of three winter months (December, January, and February) were utilized for analysing precipitation.

CDS analysis supports the assumption that temperature rise, and rainfall decrease and fluctuation have been taking place in the region for the last 40 years steadily. It could be clearly noticed from figure 4-3 and figure 4-4 that temperature has been increasing over the last 40 years in a rate of 5.47% yearly.

Figure 4-5, and Figure 4-6, on the other hand show that precipitation has been decreasing over the last 40 years in a rate of 2.42% yearly.

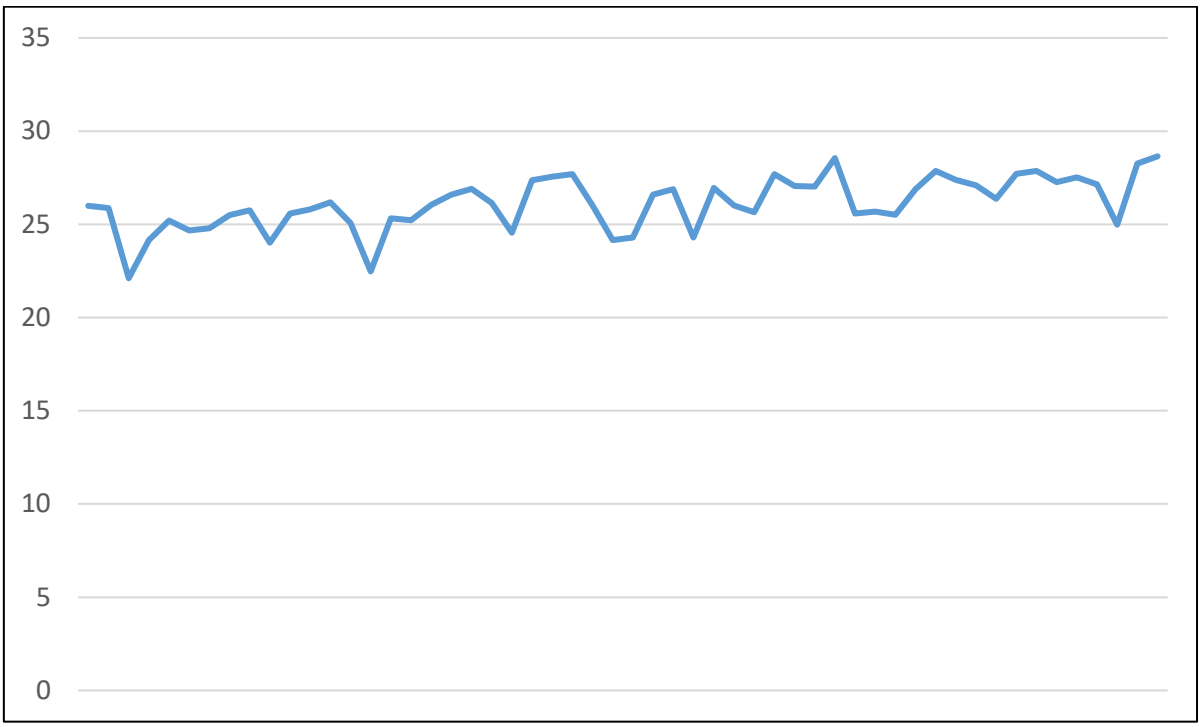

Figure 4-3: Climatology mean - near-surface air temperature - July, August, September (hot months in Gaza) of the years 1980 - 2020, Gaza, Palestine.

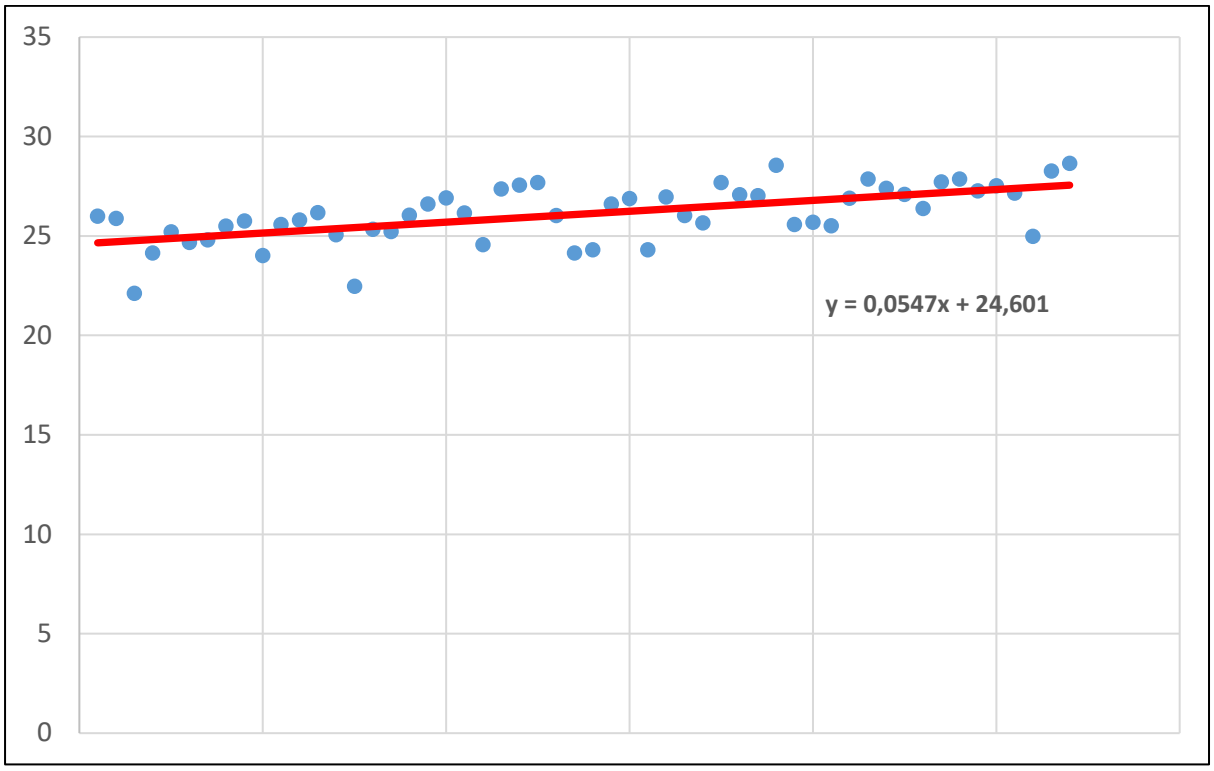

Figure 4-4: Climatology mean - near-surface air temperature - Trend diagram

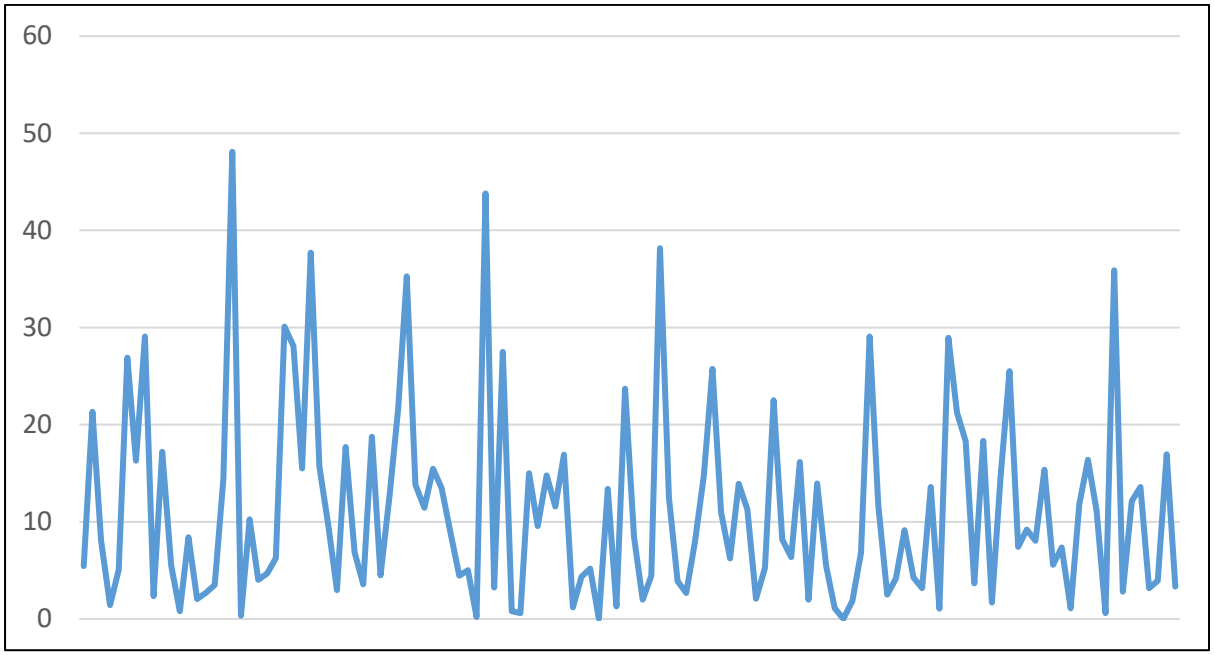

Figure 4-5: Climatology mean - Total precipitation- January, February, December (rainy months in Gaza) of the years 1980, 1990-2020 - Gaza, Palestine

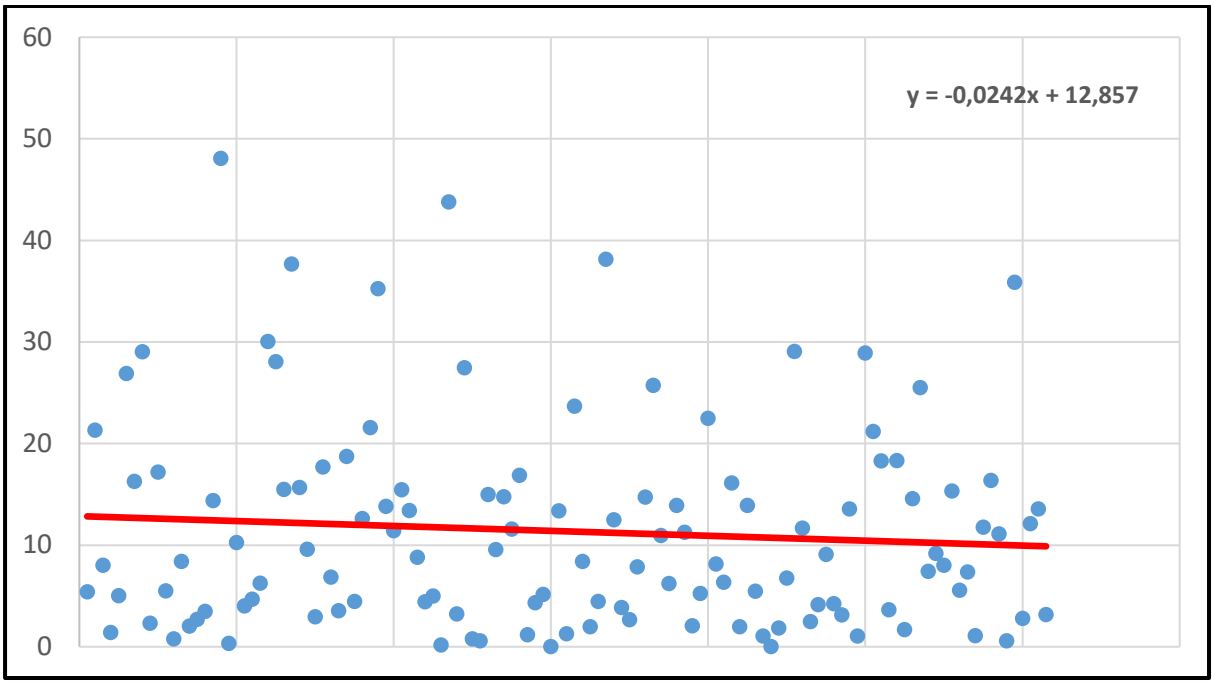

Figure 4-6: Climatology mean - Total precipitation- Trend diagram

4.3 Focus groups results

The following ideas (table 4-2) were concluded from the focus groups (refer to section 3.5.1 in chapter 3 for more details about focus groups conducted in this regard):

Table 4-1: Focus groups outcome

No.	Topic/question	Outcome of discussion
1.	Based on your experience, what climate changes have you been noticing in the last few years compared to past? And how this affected your farms' production?	<u>Climate changes:</u> 1. Most noticeable effects of climate change are heat stress and fluctuation of rainfall. This has been clearly noticed in the last 3-5 years. 2. In Rafah area (extreme south), storms are believed to be more negatively influencing agricultural production than rainfall fluctuation (this could be attributed to the nature of area (rural) where almost no high buildings exist, allowing for higher effect of wind on farmlands). 3. Salinity of groundwater comes in the second rank as an environmental problem (indirect effect of climate change) negatively affecting agriculture. Due to scarcity of rainfall, excessive consumption of groundwater (wells) takes place, leading to sea water intrusion to aquifers, and hence raising groundwater salinity (exceeding 3,000 ppm). <u>Effect on crops:</u> 1. Fluctuation of rain leads to poor irrigation, as well as heat stress. This affects the quality and quantity of crop production. For example, wheat grains grow semi-empty, which reduces the whole production quantity and quality of manufactured outcome, flour. 2. Due to early attack of heat waves in June, watermelon crops are damaged in some seasons, leading to scarcity of this fruit in market. 3. New pests have been recently noticed on plants, especially in hot seasons. 4. A difference in water salinity between north and south of Gaza has been noticed recently. Therefore, some crops are now hardly being planted in southern areas, such as cucumber, ipomoea batatas, and watermelon. 5. A recently-noticed difference in temperature, as well, between north and south has led to economic superiority of north in planting and marketing some crops such as potato. This is attributed to the fact that southern farmers have to wait longer for weather to be more moderate in order to start planting their potato crops, while northern ones, on the other hand, plant potato earlier, benefitting from early-coming moderate weather.
2.	What basic needs do you think that	1. Security, especially in farmlands close to border with Israel (no-go zone). These farmlands witness armed activities either by Israeli forces and/or Palestinian troops. In conflicts, these areas

	farmers are lacking in their family and farming lives to be more adaptive to climate changes? i.e. financial needs? security? access to credit? water security? food security?	become very risky, and the farmer either risks his/her life to visit their farms, or leaves crops until the end of armed conflict, which subjects crops to damage in most cases. Furthermore, Israeli forces used to spray chemicals in this no-go zone to kill plants that might block surveillance systems' vision, which causes damage to plants close to border as well. 2. Weakness of economic governmental control on crop business. This makes farmers vulnerable in market, with the financial power and monopoly in hand of investors and owners of capital (government officers or supported by government leaders). Farmers are obliged to sell their products for the price determined by traders, or their crops would not be sold (as they don't have direct access to market). This contributes to the economic vulnerability of farmers. 3. Lack of development projects, especially those for desalination, irrigation, and/or energy (windmills for example). Farmers are willing to pay (by credit or installments) if investment in these projects is arranged by government or international organizations. 4. Lack of financial strength (access to credit, ability to cover insurance cost, governmental support), especially after conflicts and climate-driven disasters.
3.	What techniques do you use in your farming activities to adapt to climate changes, especially those you see as highly influential?	1. Waiting for weather to be more moderate to plant certain crops, which causes many farmers to lose competitive advantage in market due to their late production (example: potato crop in south compared to north, detailed in part (1) above 'effect on crops, paragraph (5)'). 2. Using fans in greenhouses to reduce temperature. 3. Placing plastic sheets on land after making holes in them for plants to grow. This can conserve moisture in soil, reduce evaporation of irrigating water, and mitigate heat intruding sand. 4. Growing up corn plants around farmland and between crops. This can create shadow and hence decrease heat, attract bees that help in transferring pollen, and enhance soil's fertility. 5. Planting certain crops once each two or three years, such as wheat and barely, which are known as effective absorbent of soil salinity.

<u>To sum up:</u>

- Most influential climate changes in the Gaza Strip are heat stress and rainfall fluctuation, which supports the results of literature review and desk research.
- Socioeconomic vulnerabilities lead to lower adaptive capacity. This could be inferred from linking both of the following facts highlighted by farmers:
  a) Poor socioeconomic status (answers of question 1), under harsh climatic conditions (answers of question 2), and
  b) Poor methods/techniques of adaptation to climate changes (answers of question 3).

4.4Questionnaire results

Questionnaire analysis aims to:

1) measure the influence of socioeconomic and socio-political factors (paragraphs in parts I and II in the questionnaire – appendix 1) on farmers' adaptive capacity (assessed using Likert scale in Part III). This will be done using hypotheses-testing analysis in section 4.4.3.
2) measure farmers' adaptive capacity to climate change. This is part III of the questionnaire where five dimensions were used to assess farmers' adaptive capacity using Likert scale. The analysis includes investigating the validity of each paragraph to measure related dimension (economic wellbeing, technology, etc), and the validity of dimensions to measure the whole variable (adaptive capacity). This testing was done using Pearson's correlation coefficient (r), and P-value.

4.4.1 Validity, reliability, and normality of the Questionnaire

As described above, correlation coefficients, in table 4-3, indicate the level of correlation (r) between each paragraph and its own dimension, and to what level this correlation is significant at a level of 0.05 (P-value). It could be inferred from table 4-3 that all correlation coefficients are greater than 0.5, and this is significant at the level of 0.05, meaning that the paragraphs are correlated and valid to measure their related dimensions.

Table 4-2: Internal validity of questionnaire paragraphs

Paragraph (refer to questionnaire in appendix 1 for full text of paragraphs)	Correlation coefficient (r)	P-value
First dimension: Economic wellbeing.		
1	0.89	0.000*
2	0.90	0.000*
Second dimension: Technology.		
1	0.60	0.000*
Third dimension: Infrastructure.		
1	0.71	0.000*
2	0.69	0.000*
3	0.71	0.000*
4	0.64	0.000*
5	0.49	0.000*
Fourth dimension: Information and skills.		
1	0.73	0.000*
2	0.73	0.000*
3	0.71	0.000*
4	0.69	0.000*
Fifth dimension: Institutions and social capital		
1	0.67	0.000*
2	0.70	0.000*
3	0.63	0.000*
4	0.81	0.000*
5	0.72	0.000*
6	0.71	0.000*

* Correlation is statistically significant at $\alpha \leq 0.05$.

Structural Validity

In this part, the validity of each dimension to measure the whole variable (farmers' adaptive capacity) is investigated. Same as above, (r) and P-values are used to assess correlation between each dimension and the whole variable (table 4-4). The correlation coefficients are greater than 0.5 and are statistically significant at $\alpha \leq 0.05$, indicating that each dimension is valid to measure farmers' adaptive capacity.

Table 4-3: The correlations coefficient between five dimensions of adaptive capacity (refer to conceptual framework in chapter 1) and the total degree of the questionnaire

Dimension	Correlation coefficient	P-value
Economic wellbeing	0.65	0.000*
Technology	0.60	0.000*
Infrastructure	0.70	0.000*
Information and skills	0.79	0.000*
Institutions and social capital	0.80	0.000*

Reliability of the Questionnaire:

The value of Cronbach's alpha for the total questionnaire is found 0.86, which expresses a high coefficient of reliability.

Normal Distribution Test: Kolmogorov - Samarnov Test

To test if the data (questionnaire respondents' entries) follow normal distribution, Kolmogorov - Samarnov Test is used. As shown in Table 4-5 below, the P-value of each dimension is greater than 0.05 (sig. > 0.05), indicating that the data follow a normal distribution and parametric tests could be used.

Table 4-4: Normal Distribution Test

	Z-Value	P-value
Adaptive capacity to climate change	0.96	0.30

4.4.2 Questionnaire parts analysis

Firstly, the socioeconomic status and adaptive-capacity-related political status/views of those who participated in the questionnaire is analysed. This expresses the general trend of both statuses of sample respondents.

4.4.2.1 Part I – Socioeconomic status

Section 1: General information

Table 4-6 shows the following:

- Most of respondents are male, which reflects that female workers are minority in agricultural sector in Gaza.
- There is a relatively high percentage of disability. This could be attributed to conflicts with Israel in which a high number of people were subject to amputation.
- Regarding age, the highest record is for people between 18-55, indicating that the majority of farmers' community is youth.
- Most of respondents have large families (more than 7 dependents), which reflects the nature of peasant communities where people tend to have more children to support them in farming works.
- The number of respondents is the highest in Khan Younis governorate, which is normal since Khan Younis is the largest Gazan governorate in area, and the one having the highest

contribution of crop production in the Gaza Strip ((Palestinian Central Bureau of Statistics PCBS, 2022).

Table 4-5: Socioeconomic status - general information

Variable	Frequency	Percentage %
Gender		
Male	288	86.5
Female	45	13.5
Marital status		
Single	45	13.5
Married	271	81.4
Separated	10	3.0
Widow	7	2.1
Disability		
Yes	64	19.2
No	269	80.8
Age		
Less than 18 years	9	2.7
18-35 years	120	36.0
36-55 years	166	49.8
More than 55	38	11.4
Number of dependents in household		
1-3	54	16.2
4-6	136	40.8
7 or more	143	42.9
Governorate		
North	59	17.7
Gaza	42	12.6
Middle area	57	17.1
Khan Younus	111	33.3
Rafah	64	19.2
Total	**333**	**100.0**

Section 2: Education level and awareness of climate change issue

Table 4-7 reflects that most of farmers are educated, with the highest percentage being for those holding a university degree. However, the majority responded that they have never attended any training on climate change.

Table 4-6: Education level and awareness of climate change issue

Variable	Frequency	Percentage %
Education level		
Not educated	59	17.7
Elementary	87	26.1
Secondary	87	26.1
University	100	30.0
Number of sessions, workshops, or trainings you attended in climate change		
Didn’t attend any	250	75.1
Attended	83	24.9
Years of experience in agriculture		
Less than 5	83	24.9
5 to less than 10	86	25.8
10 or more	164	49.2
Total	**333**	**100.0**

Section 3: socioeconomic strengths

As shown in Table 4-8, The vast majority of respondents have negative indicators with respect to employment, insurance coverage, access to credit, membership of social organizations, and receiving financial support from family or community. This reflects a clear high level of vulnerability and brittleness of socio-economic situation.

Table 4-7: socioeconomic strengths

Variable	Frequency	Percentage%
Family monthly income		
Less than 1000 NIS	240	72.1
1000-2000 NIS	75	22.5
2001-3000 NIS	18	5.4
Number of employees in the household		
Less than 3	310	93.1
3 to less than 6	23	6.9
Extent of insurance		
No	325	97.6
Yes	8	2.4
Using bank credit to support your farming activities/business		
No	306	91.9
Yes	27	8.1
Land ownership		
Owned	158	47.4
Rented	148	44.4
You work in land owned by others	27	8.1
Land area in donums		
Less than 10	204	61.3
10 to less than 20	101	30.3
20 or more	28	8.4
Extent of membership of a social organization		
No	292	87.7
Yes	41	12.3
Extent of financial support from family or community		
No	278	83.5
Yes	55	16.5
Total	333	100.0

4.4.2.2 Part II: Socio-political status

Section 1: Water security

It can be inferred from (table 4-9) below that decentralization of water resources is not fulfilled. This can be concluded from:

- The relatively long distance between farm and irrigation source (majority 100-500m and more than 500m).
- Most of the domestic water is controlled by municipality.
- Most of farmers' households depend on buying water for drinking, which means that drinking water comes from other (maybe distant) locations.

Drinking water quality, however, is claimed to be good by most of respondents, since most of them buy drinking water, which creates competitiveness between water distribution companies for providing better quality. Nevertheless, this might generate higher expenses.

Table 4-8: Responses' statistics on water resources

Variable	Frequency	Percentage %
Domestic water sources used in house		
Municipal	214	64.3
Wells	108	32.4
Other	11	3.3
Drinking water source in house		
Municipal	76	22.8
Wells	30	9.0
Rain	2	.6
desalination system	19	5.7
Buying water	206	61.9
Evaluate drinking water quality in house		
Very good	41	12.3
Good	177	53.2
Fair	99	29.7
Bad	10	3.0
Very bad	6	1.8
Water source for irrigation		
Municipal	45	13.5
Wells	214	64.3
Rain	3	.9
Treated wastewater	6	1.8
Buying water	65	19.5
Distance between farm and irrigation source		
less than 100m	81	24.3
100-500m	132	39.6
More than 500m	120	36.0
Total	333	100.0

Section 2: Regulations of agriculture

This part of the questionnaire tries to measure political stability as a contributor to adaptive capacity. It could be inferred from (table 4-10) that there is an instable relationship between farmers and government (considering that about half respondents don't or fully don't agree with laws organizing agriculture sector). Furthermore, there is a probability that those who responded (agree and fully agree) could be reluctant to tell the truth being under the control of extremist party known by its oppression to opponents. This argument could be supported by the outcomes of focus group, where most of farmers complained of the lack of governmental control on markets.

Table 4-9: Responses' statistics on regulations controlling agriculture sector in Gaza

Variable	Frequency	Percentage %
The extent of accepting regulations and laws organizing agriculture sector		
Fully agree	29	8.7
Agree	126	37.8
I don't know	78	23.4
Not agree	76	22.8
Fully not agree	24	7.2
Total	333	100.0

Section 3: Conflict with Israel

Table 4-11 Shows that most respondents (75%) had losses of less than $50,000 due to conflicts with Israel. This indicates a high loss if to consider the low income of farmers in Gaza (with $50,000 is a huge loss in their case).

Table 4-10: Responses' statistics on the effect of conflict with Israel

Variable	Frequency	Percentage%
Estimated financial losses due to the four conflicts with Israel (2008-2021)		
Less than 10,000$	146	43.8
10,000-50,000$	106	31.8
50,000-100,000$	62	18.6
More than 100,000$	19	5.7
Distance between farm and Israeli fence		
less than 700 m	59	17.7
700-1500m	190	57.1
more than 1500 m	84	25.2

Section 4: Female empowerment

The very low percentage of females working in farm (table 4-12) indicates a low level of female empowerment.

Table 4-11: Responses' statistics on female empowerment

Variable	Percentage %
Percentage of females working in the farm	1.2%

4.4.2.3 Part III: Adaptive capacity to climate change

The five-point Likert scale (Likert, 1932) is used to measure responses on this part of questionnaire. An answer of (1) means that a respondent very-lowly agrees with a paragraph, while an answer of (5) represents fully acceptance. The mean of all answers of each paragraph can fall within one of the ranges described in table 4-13. Relative weight represents Mean's value expressed in 100%.

Table 4-12: Likert Scale

Degree of approval	Mean	Relative Weight %
very low	1-1.80	20-36%
Low	1.80-2.60	36-52%
Medium	2.60-3.40	52-68%
High	3.40-4.20	68-84%
Very high	4.20-5	84-100%

Adaptive capacity to climate change - dimensions analysis

The arithmetic mean of each dimension of adaptive capacity is determined (the average means of all paragraphs representing a single dimension). In table 4-14, the mean of economic wellbeing (2.62), for example, means that the mean of all responses of this section on Likert scale is 2.62, which refers to a medium condition of economic wellbeing. This leads to a total of (3.16) as an overall degree of adaptive capacity to climate change of farmers in Gaza. A score of (3.16) is equivalent to a relative weight of 63.2% (medium). Infrastructure dimension

is ranked first with relative weight of (67.5%), while the information and skills dimension is ranked second with relative weight of (65.3%).

Table 4-13: (Adaptive capacity to climate change) dimensions analysis

No	Dimension	Mean	Standard deviation	Relative Weight %	Rank
1	Economic wellbeing	2.62	1.01	52.4*	5
2	Technology	3.21	1.17	64.2	3
3	Infrastructure	3.37	0.73	67.5	1
4	Information and skills	3.26	0.78	65.3	2
5	Institutions and social capital	3.08	0.81	61.6	4
Total degree		3.16	0.61	63.2	

* Relative weight is calculated by dividing mean on highest value of Likert scale (5) and multiplying by 100% (100%*2.62/5).

The Following Tables explain adaptive capacity dimensions analysis:

1. Economic wellbeing

The statistics of answers of each paragraph in (economic wellbeing) are determined (see table 4-15). The overall score of this dimension is 2.62 (relative weight = 52.4%). This indicates a degree of approval of medium. In other words, respondents express that their economic wellbeing (as a dimension of adaptive capacity to climate change) is **medium**.

Table 4-14: Dimension Paragraph Analysis: Economic wellbeing

Paragraph (refer to part III in questionnaire – appendix 1)	**Mean**	**Standard deviation**	**Relative Weight %**	**Rank**
1	2.48	1.12	49.6	2
2	2.76	1.14	55.2	1
Total degree	2.62	1.01	52.4	

Same as above, the analysis of other five dimensions is shown below:

2. Technology

Table 4-15: Dimension Paragraph Analysis: Technology

Paragraph (refer to part III in questionnaire – appendix 1)	**Mean**	**Standard deviation**	**Relative Weight %**	**Dimension's level**
1	3.21	1.17	64.2	**Medium**

3. Infrastructure

Table 4-16: Dimension Paragraph Analysis: Infrastructure

Paragraph (refer to part III in questionnaire – appendix 1)	**Mean**	**Standard deviation**	**Relative Weight %**	**Rank**	**Dimension's level**
1	3.41	1.11	68.2	1	**Medium**
2	3.39	1.09	67.7	3	

Paragraph (refer to part III in questionnaire – appendix 1)	Mean	Standard deviation	Relative Weight %	Rank	Dimension's level
3	3.31	1.13	66.2	5	
4	3.36	1.08	67.3	4	
5	3.40	1.14	68.0	2	
Total degree	3.37	0.73	67.5		

4. Information and skills

Table 4-17: Dimension Paragraph Analysis: Information and skills

Paragraph (refer to part III in questionnaire – appendix 1)	Mean	Standard deviation	Relative Weight %	Rank	Dimension's level
1	3.32	1.18	66.3	2	Medium
2	3.37	1.06	67.3	1	
3	3.24	1.03	64.7	3	
4	3.14	1.09	62.8	4	
Total degree	3.26	0.78	65.3		

5. Institutions and social capital

Table 4-18: Dimension Paragraph Analysis: Institutions and social capital

Paragraph (refer to part III in questionnaire – appendix 1)	Mean	Standard deviation	Relative Weight %	Rank	Dimension's level
1	3.01	1.06	60.1	4	Medium
2	2.98	1.18	59.6	6	
3	3.10	1.13	61.9	3	
4	3.01	1.17	60.1	5	
5	3.11	1.07	62.2	2	
6	3.28	1.16	65.6	1	
Total degree	3.08	0.81	61.6		

4.4.3 Hypotheses Testing

The First Main Hypothesis: There are statistical significant differences at level $\alpha \leq 0.05$ among respondents of the research sample about adaptive capacity to climate change due to Socioeconomic status (disability, age, etc).

Sub hypotheses were outlined as follows:

There are statistically significant differences at level $\alpha \leq 0.05$ among respondents of the research sample about adaptive capacity to climate change:

1. due to disability

To test the hypothesis, t-test has been utilized to study the differences among respondents of the research sample about adaptive capacity due to disability. Results, as shown in table 4-20, indicate that the p-value (sig.) equals 0.936 which is more than the significance level ($\alpha \leq 0.05$), thus it can be concluded that there are no differences among respondents about adaptive capacity due to disability.

Table 4-19: Differences among respondents due to disability

Disability	Mean	STD	T	P-Value
Yes	3.15	0.71	0.81	0.936//
No	3.16	0.59		

// Value of "P-Value" not statistically significant

2. due to age

To test the hypothesis, (One-way ANOVA) test has been utilized. Results, as shown in table 4-21, indicate a p-value of 0.243 indicating no differences among respondents due to age.

Table 4-20: Differences among respondents due to age

Source of variation	Sum of Squares	DF	Mean Square	F	P-Value
Between groups	2.04	4	0.51	1.373	0.243//
Within groups	121.69	328	0.37		
Total	123.73	332			

3. due to number of dependents in household

Using same way of conclusion as in hypotheses (1) and (2), (One-way ANOVA) test shows that there are no differences among respondents due to number of dependents in household (table 4-22).

Table 4-21: Differences due to number of dependents in household

Source of variation	Sum of Squares	DF	Mean Square	F	P-Value
Between groups	0.30	2	0.15	0.395	0.674//
Within groups	123.43	330	0.37		
Total	123.73	332			

4. due to difference in governorate

There are differences among respondents due to difference in governorate (table 4-23) (One-way ANOVA test). To find out the differences, the Scheffe test (Statistics-How to, 2022) was used. This has revealed that the differences are in favour of the northern governorates.

Table 4-22: Differences due to difference in governorate

Source of variation	Sum of Squares	DF	Mean Square	F	P-Value
Between groups	18.05	4	4.51	14.006	0.000*
Within groups	105.68	328	0.32		
Total	123.73	332			

* Value of "P-Value" statistically significant

5. due to education level

There are differences due to education level. Scheffe test revealed that the differences are in favour of the university-graduates category (table 4-24) (One-way ANOVA) test.

Table 4-23: Differences due to education level

Source of variation	Sum of Squares	DF	Mean Square	F	P-Value
Between groups	5.83	3	1.94	5.420	0.001*
Within groups	117.90	329	0.36		
Total	123.73	332			

6. due to number of sessions, workshops, or trainings a farmer attended on climate change

Using t-test, it can be said that **there are differences** among respondents due to number of sessions, workshops, or trainings a farmer attended on climate change. The differences were in favour of those who have attended courses on climate change (table 4-25).

Table 4-24: Differences due to number of sessions, workshops, or trainings a farmer attended on climate change

Number of sessions	Mean	STD	T	P-Value
Didn't attend any	3.08	0.63	4.834	0.000*
Attended	3.39	0.45		

7. due to years of experience in agriculture

One-Way ANOVA test shows that **there are differences** due to years of experience in agriculture (Table 4-26). The differences were in favour of those who have (5 to less than 10 years of experience) category.

Table 4-25: Differences due to years of experience in agriculture

Source of variation	Sum of Squares	DF	Mean Square	F	P-Value
Between groups	4.83	2	2.41	6.699	0.001*
Within groups	118.90	330	0.36		
Total	123.73	332			

8. due to family monthly income

One-Way ANOVA test shows that **there are differences** due to family monthly income (Table 4-27), indicate that the p-value (sig) equals 0.006 which is less than the significance level $\alpha \leq 0.05$). The differences were in favour of those whose income is (2001-3000 NIS), knowing that this is the highest income in responses as no one of the sample selected (more than 3000 NIS) category.

Table 4-26: Differences due to family monthly income

Source of variation	Sum of Squares	DF	Mean Square	F	P-Value
Between groups	3.76	2	1.88	5.173	0.006*
Within groups	119.97	330	0.36		
Total	123.73	332			

9. due to land ownership

One-Way ANOVA test shows that there are no differences due to land ownership (Table 4-28).

Table 4-27: Differences due to land ownership

Source of variation	Sum of Squares	DF	Mean Square	F	P-Value
Between groups	0.15	2	0.07	0.197	0.821//
Within groups	123.58	330	0.37		
Total	123.73	332			

// Value of "P-Value" not statistically significant

10. due to farm area

One-Way ANOVA test shows that there are no differences due to land area (Table 4-29).

Table 4-28: Differences due to farm area

Source of variation	Sum of Squares	DF	Mean Square	F	P-Value
Between groups	1.89	2	0.94	2.554	0.079//
Within groups	121.84	330	0.37		
Total	123.73	332			

11. due to membership of a social organization

T-test shows that there are no differences due to membership of a social organization (Table 4-30).

Table 4-29: Differences due to membership of a social organization

Extent of membership of a social organization	Mean	STD	T	P-Value
No	3.14	0.62	1.139	0.259//
Yes	3.23	0.45		

12. due to extent of financial support from family or community.

T-test (Table 4-31) shows that **there are differences** due to the extent of financial support from family or community. The differences are in favour of not receiving support from family or community.

Table 4-30: Differences due to extent of financial support from family or community

Extent of financial support from family or community	Mean	STD	T	P-Value
No	3.22	0.60	5.018	0.000*
Yes	2.82	0.52		

* Value of "P-Value" statistically significant

The Second Main Hypothesis: There are statistical significant differences at level $\alpha \leq 0.05$ among respondents of the research sample about adaptive capacity to climate change due to Socio-political status (drinking water quality in house, water source for irrigation, etc).

Sub hypotheses were outlined as follows:

There are statistically significant differences at level α ≤ 0.05 among respondents of the research sample about adaptive capacity to climate change:

1. due to drinking water quality in house

One-Way ANOVA test (Table 4-32) shows that **there are differences** due to drinking water quality in house. Scheffe test revealed that the differences are in favour of the (Fair) category.

Table 4-31: Differences due to drinking water quality in house

Source of variation	Sum of Squares	DF	Mean Square	F	P-Value
Between groups	7.04	4	1.76	4.984	0.001*
Within groups	116.69	328	0.36		
Total	123.73	332			

* Value of "P-Value" statistically significant

2. due to Water source for irrigation

One-Way ANOVA test (Table 4-33) shows that **there are differences** due to water source for irrigation. Scheffe test revealed that the differences are in favour of the (Municipal) category.

Table 4-32: Differences due to water source for irrigation

Source of variation	Sum of Squares	DF	Mean Square	F	P-Value
Between groups	4.56	4	1.14	3.136	0.015*
Within groups	119.17	328	0.36		
Total	123.73	332			

3. due to distance between land and irrigation source

One-Way ANOVA test (Table 4-34) reveals that **there are differences** due to distance between land and irrigation source. Scheffe test revealed that the differences are in favour of the (less than 100m) category.

Table 4-33: Differences due to distance between land and irrigation source

Source of variation	Sum of Squares	DF	Mean Square	F	P-Value
Between groups	2.35	2	1.17	3.189	0.042*
Within groups	121.38	330	0.37		
Total	123.73	332			

4. due to the extent of accepting regulations and laws organizing agriculture sector

One-Way ANOVA test (Table 4-35) shows that **there are differences** due to the extent of accepting regulations and laws organizing agriculture sector. Scheffe test revealed that the differences are in favour of the “Fully agree” category.

Table 4-34: Differences due to the extent of accepting regulations and laws organizing agriculture sector

Source of variation	Sum of Squares	DF	Mean Square	F	P-Value
Between groups	32.18	4	8.05	28.829	0.000*
Within groups	91.54	328	0.28		
Total	123.73	332			

5. due to financial losses due to the four conflicts with Israel (2008-2021)

One-Way ANOVA test (Table 4-36) shows that there are no differences due to financial losses due to the four conflicts with Israel (2008-2021).

Table 4-35: Differences due to financial losses due to the four conflicts with Israel (2008-2021)

Source of variation	Sum of Squares	DF	Mean Square	F	P-Value
Between groups	2.62	3	0.87	2.375	0.070//
Within groups	121.10	329	0.37		
Total	123.73	332			

// Value of "P-Value" not statistically significant

6. due to distance between farm and Israeli fence.

One-Way ANOVA) test (Table 4-37) shows that **there are differences** due to distance between farm and Israeli fence. Scheffe test revealed that the differences are in favour of the "more than 1500m" category.

Table 4-36: Differences due to distance between farm and Israeli fence

Source of variation	Sum of Squares	DF	Mean Square	F	P-Value
Between groups	3.08	2	1.54	4.212	0.016*
Within groups	120.65	330	0.37		
Total	123.73	332			

* Value of "P-Value" statistically significant

7. There is a statistically significant correlation at α≤0.05 between Adaptive capacity to climate change and Percentage of the number of females working in the land.

To check this hypothesis, Pearson correlation coefficient is used to study the relation between adaptive capacity to climate change and percentage of females working in farm (because they are both quantitative variables). The results are shown in Table 4-38 below.

Table 4-37: The relationship between adaptive capacity to climate change and percentage of females working in farm

Adaptive capacity to climate change	Percentage of females working in the farm	
	Correlation Coefficient (R)	P-value
	0.29	0.000*

* Correlation is statistically significant at $\alpha \leq 0.05$

The analysis reveals positive correlation with statistical significance between adaptive capacity to climate change and percentage of females working in farms, as the P-value is less than 0.05. this means that female empowerment influences adaptive capacity to climate change.

4.4.4 Summary of statistical analysis

Table 4-38 below summarizes the statistical significance analysis of the above dimensions on adaptive capacity, with explanation of the researcher.

Table 4-38: Statistical significance of influence of socioeconomic and socio-political dimensions on adaptive capacity to climate change, with explanation.

Dimension	Statistical significance of influence on adaptive capacity	Comment
Socioeconomic status		
Disability	No	The Palestinian community, especially rural/agricultural areas, is known for its social bonding and solidarity. A person suffering of disability is always supported by family (spouse, sons and daughters, and extended family 'tribe'). This might be the reason behind the result that disability doesn't have influence on adaptive capacity.
Age	No	Age doesn't have influence on adaptive capacity in this study. This could be attributed to nature of families working in farming in Gaza, where extended family is the common pattern. This makes older and more experienced people always in support of those who are younger.
Number of dependents in household	No	Low standard of living in agricultural areas reduces the burden of growing up large families (more than 7 dependents), as the expenses and daily needs are lower compared to people living in cities and urban areas of Gaza.
Governorate	Yes (in favour of the northern governorate)	Northern governorate is more adaptive to climate change upon the results of this study. This could be attributed to the fact that northern governorate is the closest (geographically) to Gaza city, the political, economic, and administrative capital of the Gaza strip. Farmers of the north can access Gaza city services, markets, and governmental offices faster and easier than other farmers in the Gaza Strip. Moreover, upon researcher's knowledge of the context of Gaza, Hamas party (grasping the De facto government in Gaza) exists in large concentration (number of leaders, supporters and affiliates) at northern governorate, which might had directed governmental support to that governorate more than others.
Education level	Yes (in favour of the university-graduates category)	It is reasonable and pre-expected that more educated farmers have more adaptive capacity to climate change.
Number of sessions, workshops, or trainings a farmer attended on climate change	Yes (in favour of those who have attended courses on climate change.)	Same as previous.
Years of experience in agriculture	Yes (in favour of those who have (5 to less than 10 years of experience)	This could be explained as follows: since the highest number of participants have experience more than 10 years, and since the total relative weight of adaptive capacity status is 63.2% (medium: 52-68%), which is closer to (low), the higher adaptive capacity could be in favour of the less-experienced category (5 to less than 10 years of experience).
family monthly income	Yes (in favour of those whose income is (2001-3000 NIS)	It is reasonable that higher-income farmers have more adaptive capacity to climate change, knowing that this category "2001-3000 NIS" is the highest income in responses as no one of the sample selected "more than 3000 NIS" category.
Land ownership	No	

Land area in donums	No	Neither land ownership nor farm area influence farmers' adaptive capacity to climate change. Culture (traditions, beliefs, and customs) has something to do here (researcher's explanation upon knowledge of context). Farmers are known in the Palestinian community as people who dedicate their full time and effort to their work. This makes them seek adaptive solutions regardless of the farm area, and if the farm is owned by self or others.
Membership of a social organization	No	Membership of a social organization doesn't influence adaptive capacity to climate change. This could be attributed to the assumption that these organizations themselves are not well-prepared to adapt to climate change or help farmers to do. The highest support in this regard comes from international organizations as stated by farmers in the focus groups.
Extent of financial support from family or community	Yes (in favour of the those who do not receive financial support from the family or the community)	The higher adaptive capacity of those who don't receive financial support from family or community can be attributed to the assumption that those farmers are financially self-dependent, hence are more prepared to hazards (more adaptive).
Socio-political status		
Drinking water quality in house	Yes (in favour of the (Fair) category)	Farmers who afford to receive (fair-quality) water are more adaptive, since they might have gained their higher adaptive capacity from other sources, such as income.
Water source for irrigation	Yes (in favour of the (Municipal) category)	Farmers depending on municipal water for irrigation have more adaptive capacity. This could be attributed to the low cost of and accessibility to this water. On the other hand, farmers who have to irrigate using wells (needs high-cost energy for pumping), market water (higher cost), rain (fluctuated), and treated wastewater (quality not guaranteed) may have more complexities in securing water for irrigation, as mentioned between brackets.
Distance between land and irrigation source	Yes (in favour of the (less than 100 m) category)	It is reasonable that less distance to irrigation source (decentralization of water resource) leads to more adaptive capacity to climate change.
The extent of accepting regulations and laws organizing agriculture sector	Yes (in favour of the (Fully agree) category)	Farmers who are fully accepting regulations are less probable to go into disputes with government, which could have contributed to their higher adaptive capacity.
Estimated financial losses due to the four conflicts with Israel "2008-2021"	No	The researcher expected that this dimension has a large influence on adaptive capacity, however it is found to be of weak influence (p-value = 0.070, close to 0.05). This may be attributed to the fact that adaptive capacity is accumulative, i.e. not just acquisitioned from personal strengths, but from context-related ones as well. Moreover, it could be logical to assume that, in case of Gaza farmers 'poor economy' "loss is loss", whether it is low or high, this is why there are no differences among respondents of the research sample regarding the influence of estimated financial losses on adaptive capacity to climate change.
Distance between farm and Israeli fence 'no-go zone'	Yes (in favour of the (more than 1500 m) category)	It is reasonable that more distance between farm and the risky 'no-go zone' means more visits to farm, less Israeli attacks, less influence of armed conflicts, hence more productivity and more adaptive capacity to climate change.

Percentage of females working in the farm	Yes	It is reasonable that female empowerment leads to more adaptive capacity to climate change.

4.5 Discussion

In this chapter, the results of the three research methods used in the study were introduced. Literature review helped in focusing ideas, setting research priorities, and knowing where contextual and global studies are standing regarding: socioeconomic and socio-political statuses assessment, climate change manifestations, adaptive capacity to climate change, and the effect of this (mix) on Gazan farmers' and agriculture's resilience. Like an ice ball, each research method led to -and paved road for- the next one. After the significant preparedness the literature provided, desk research helped in retrofitting research path and focusing on specific climate change manifestations (by showing in numbers and graphs the increase and decrease of heat and rainfall respectively). This mitigated time and effort and helped in preparing for a sufficient and rich-with-ideas focus group. The focus group produced a plenty of context-related insights, and put the hand of researcher on actual contextual factors that should be addressed in the questionnaire to measure (adaptive capacity to climate change) in correlation to socioeconomic and socio-political statuses of farmers.

Reaching the point of questionnaire, ideas were clear and focused. This is attributed to the way how mixed methods were arranged/combined to reach optimum quantity and quality of data before analysis. Hence, the questionnaire revealed results that match the seen reality in the sense that socioeconomic and sociopolitical situations in the Gaza Strip are noticed to be extremely declining, which reflects on farmers' adaptive capacity to climate change.

Applying triangulation and mixed method in research helped in revealing insights and results regarding specific context-related issues, such as the influence of proximity to Israeli borders on adaptive capacity to climate change. This element particularly wouldn't have been tackled unless it was highlighted by farmers in focus group, and it proved high influence on adaptive capacity level (questionnaire analysis), especially in cases of floods (fluctuation of rainfall proved in CDS analysis). A very significant recommendation that could emerge from this well-triangulated result is that government and NGOs should focus on supporting the resilience and adaptation of farms close to borders rather than others as they have the minimum adaptive capacity due to their geographical location.

Chapter 5. Conclusions

The study investigates a principal question of the extent to which political and socioeconomic statuses affect the level of adaptive capacity to climate change among Palestinian farmers in the Gaza Strip, with specific focus on heat stress and fluctuation of precipitation.

Literature addressing Gaza context tackled socioeconomic and socio-political situations but didn't introduce explicit assessment concentrating on Gazan farmers' conditions, neither their adaptive capacity to climate change, nor the relationship between both variables.

Upon literature (Chapter 2), general socioeconomic and socio-political situations of Gaza are declining but no one knows how this affects farmers and agriculture. In parallel, climate is changing but no manifestations are well-studied in Gaza. Adaptive capacity to climate change of Gazan farmers has not been assessed using a scientific approach before.

These gaps in literature highlight the necessity of research question (first paragraph), as well as the following sub-questions

1. What are the most influencing long-term climate change effects in the Gaza Strip, upon literature and Climate Data Store (CDS) models?
2. To what extent does socioeconomic status influence adaptive capacity to climate change of farmers in Gaza?
3. To what extent does socio-political status (political turbulence and repeated armed conflicts) influence adaptive capacity to climate change of farmers in Gaza?

Upon the results of this study (chapter 4), the following could be highlighted:

5.1 Most influential climate change components

It could be concluded that temperature rise, and rainfall scarcity and fluctuation are the climate change components that have most tangible effect in the Gaza Strip, especially on agriculture. This was checked using CDS analysis and confirmed in focus groups by farmers.

CDS analysis proved a temperature rise and rainfall scarcity, taking place for the last 40 years steadily. Temperature has been increasing in a rate of 5.47% yearly, while precipitation has been decreasing in a yearly rate of 2.42%.

5.2 Adaptive capacity to climate change

Gaza farmers' adaptive capacity to climate change has been assessed upon five major components: economic wellbeing, technology, infrastructure, information and skills, and social capital. Likert scale was used to measure the level of farmers' status with respect to these five components through a questionnaire that covered 335 random sample of farmers (out of 15,600 population) from the five governorates of Gaza Strip. Under the specific climate changes of heat rise and rainfall decrease, farmers of Gaza are found to have (medium) adaptive capacity. The questionnaire also measured the influence of Socioeconomic and socio-political status on the adaptive capacity to climate change of those farmers as detailed in the following section.

5.3 Socioeconomic and socio-political status influence on adaptive capacity to climate change

To assess the influence of socioeconomic and socio-political status on the adaptive capacity of farmers, certain indicators were selected (refer to operationalization table 3-1).

Most respondents have negative indicators with respect to employment, insurance coverage, access to credit, membership of social organizations, and receiving financial support from

family or community (Almost all of them don't have these strengths). This reflects a clear high level of vulnerability of farmers' socio-economic situation.

Upon questionnaire analysis (refer to table 4-38), the socioeconomic factors that have significant influence on adaptive capacity to climate change of farmers in Gaza are: governorate of farmer. education level, trainings addressing climate change. years of experience in agriculture, family monthly income, and the extent of financial support from family or community. In the same vein, influential socio-political factors are: water security (drinking water quality, irrigation water source, distance between land and irrigation source), the extent of accepting regulations and laws organizing agriculture sector (tendency to chaos), distance between farm and Israeli fence 'no-go zone', and percentage of females working in farm.

5.4 Recommendations

All in all, it could be concluded that a severe climate change is taking place in the area, with high negative influence on temperature and rainfall. Farmers of Gaza are not well prepared to adapt to these changes, which could negatively influence agriculture sector in the Gaza Strip in the long term.

Major sectors of influence on adaptive capacity of farmers in Gaza are education, economic well-being, water security, and political stability.

The following recommendations could be helpful in enhancing Gazan farmers' adaptive capacity to climate change upon this study:

1. Enhancing social and economic equity between Gazan governorates, especially between farmers. This might strengthen political stability and social peace, which would eventually reflect positively on adaptive capacity to climate change.
2. Developing the educational level of farmers' families/children through strictly banning children labor, supporting free/compulsory elementary education, and introducing incentives such as scholarships and free training programs.
3. Raising the income of farmers' families through, for example, supporting small-scale projects and financing farming capital expenses.
4. Enhancing water security by supporting water-sources' decentralization and raising the level of water quality and quantity per capita.
5. Developing more focus (mainly financial) on border farms, where farmers have the lowest level of adaptive capacity due to repeated armed conflicts.
6. Developing the level of female participation in agricultural-decision making, as well as participation in training programs and activities addressing climate change influence on agricultural sector of Gaza.

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Appendix 1: Questionnaire in English

Erasmus University Rotterdam
Institute of Housing and Urban Development
Track: Urban Environment, Sustainability and Climate Change

Influence of socioeconomic and socio-political status on climate-change adaptative capacity of farmers in the Gaza Strip – Palestine

Questionnaire

Through this questionnaire, the researcher seeks to investigate the impact of economic conditions and political situation (including repeated conflict with Israel) on the level of adaptation to climate changes of Palestinian farms. The study concentrates on adaptation to rising temperatures and fluctuations in rainfall causing floods and droughts.

This questionnaire serves the purposes of scientific research only, so the participant is not required to include personal name, but rather to fill in the required data accurately. The researcher undertakes the confidentiality of the data and not to use it for any purposes other than the purpose of scientific research.

The researcher hopes that participants answer questionnaire questions accurately to ensure the highest level of credibility and accuracy of the study results, to reflect a true image of the Palestinian farmers' conditions, and the impact of the variables presented in the study on their adaptation and resilience in light of climate changes.

Thanks for your time and consideration.

Researcher/ Mohammed Mahmoud Alokshiya

Part I – Socioeconomic status

Section 1: General information

1. **Gender?**
   ☐ Male ☐ Female
2. **Marital status**
   ☐ Single ☐ Married ☐ Separated ☐ Widow
3. **Do you have any disability?**
   ☐ Yes ☐ No
4. **Age**
   ☐Less than 18 years ☐ 18-35 years ☐ 36-55 years ☐ More than 55
5. **Number of dependents in household?**
   ☐ 1-3 ☐ 4-6 ☐ 7 or more
6. **Governorate**
   ☐ North ☐ Gaza ☐ Middle area ☐ Khan Younus ☐ Rafah

Section 2: Education level and awareness of climate change issue

1. **Education level**
   ☐ Not educated ☐ Elementary ☐ Secondary ☐ University
2. **Number of sessions, workshops, or trainings you attended in climate change**
   ☐ Didn't attend any ☐ Attended (Number: ----------)
3. **Years of experience in agriculture? (----------)**

Section 3: socioeconomic strengths

1. **Family monthly income**
   ☐ Less than 1000 NIS ☐ 1000-2000 NIS ☐ 2001-3000 NIS ☐More than 3000 NIS
2. **Number of emplyees in the household? (----------)**
3. **Do you have any kind of insurance?**
   ☐ No ☐ Yes (Please specify: ----------)
4. **Do you have benefitted or already are benefitting from bank credit to support your farming activities/business?**
   ☐ No ☐ Yes
5. **Land ownership?**
   ☐ Owned ☐ Rented ☐ You work in land owned by others
6. **Area of land you are working in, in donums? (----------)**
7. **Area you a member of a social organization (syndicate, NGO, agricultural cooperative organization)?**
   ☐ No ☐ Yes
8. **Do you receive any financial support from family or community?**
   ☐ No ☐ Yes

Part II: Sociopolitical status

Section 1: Water resources

1. **What is the source of domestic water you use in house?**
   ☐ Municipal ☐ Wells ☐ Rain ☐ Other: ----------
2. **What is the source of drinking water you use in house?**

3. ☐ Municipal ☐ Wells ☐ desalination system ☐ Buying water
4. **how would you evaluate drinking water quality in your house?**
   ☐ Very good ☐ Good ☐ Fair ☐ Bad ☐ Very bad
5. **what is the source of irrigation water?**
6. ☐ Municipal ☐ Wells ☐ Rain ☐ Treated wastewater ☐ Buying water
7. What is the distance between your land and irrigation source?
   ☐ less than 100m ☐ 100-500m ☐ More than 500m

Section 2: Regulations of agriculture

1. **To what extent do you agree with regulations and laws organizing agriculture sector?**
   ☐ Fully agree ☐ Agree ☐ I don't know ☐ Not agree ☐ Fully not agree

Section 3: Conflict with Israel

1. **What is the distance between your land and the Israeli fence (----------) m**
2. **How much do you estimate your financial losses due to the four conflicts with Israel (2008-2021)?**
   ☐ Less than $10,000 ☐ $10,000-$50,000 ☐ $50,000 $100,000 ☐ More than $100,000

Section 4: Female empowerment

1. **How many females working in the land you are working in (or owing)? -------**
2. **How many males working in the land you are working in (or owing)? -------**

Part III: Adaptive capacity to climate change

Please select the choice you think it expresses your case

No.	Paragraph	Fully agree	Agree	Neutral	Not agree	Fully not agree
1. Economic wellbeing						
1.1	You have your own financial resources to support you in adapting to climate change hazards, especially heat and rain fluctuation.					
1.2	You have access to external financial resources to support you in adapting to climate change hazards, especially heat and rain fluctuation.					
2. Technology						
2.1	You have ability to communicate directly with community and related parties to ask for help in case of a sudden climate-related hazard (example of hazards: flood).					

3. Infrastructure						
3.1	There is adequate and affordable water infrastructure in your area.					
3.2	There is adequate and affordable transport infrastructure in your area.					
3.3	There is adequate and affordable energy infrastructure and supply in your area.					
3.4	You have access to safe, clean drinking water in the event of a hazard occurrence (especially regarding hazards caused by change in precipitation and heat patterns).					
3.5	There is adequate medical services in close proximity.					
4. Information and skills						
4.1	Upon your estimation, government (Ministry of agriculture in particular) is aware of climate change and potential impacts/risks (especially regarding hazards caused by change in precipitation and heat patterns).					
4.2	Upon your estimation, NGOs and international organizations working in agriculture sector are aware of climate change and potential impacts/risks (especially regarding hazards caused by change in precipitation and heat patterns).					
4.3	You feel you are aware of current and/or potential impacts of climate change (based on training courses and workshops you attended in this regard) (**especially regarding hazards caused by change in precipitation and heat patterns**).					
4.4	You have emergency response skills (based on training courses and workshops you attended in this regard) (**especially regarding hazards caused by change in precipitation and heat patterns**).					
5. Institutions and social capital						
5.1	Upon your estimation, government, NGOs and international organizations are willing to allocate resources for building adaptive capacity (**especially regarding hazards caused by change in precipitation and heat patterns**).					

5.2	Community/neighborhood "leaders" intervene quickly to organize people in the event of a hazard occurrence (**especially regarding hazards caused by change in precipitation and heat patterns**).					
5.3	You feel you are engaged/involved in designing adaptation plans/decisions (**especially regarding hazards caused by change in precipitation and heat patterns**).					
5.4	The government has emergency response plans that you are trained on (**especially regarding hazards caused by change in precipitation and heat patterns**).					
5.5	NGOs and social institutions have emergency response plans that you are trained on (**especially regarding hazards caused by change in precipitation and heat patterns**).					
5.6	There are specific agencies, community groups, and/or NGOs that have the mandate and skills to focus on agriculture and farming.					

Thanks for your time

Appendix 2: Questionnaire in Arabic

Erasmus University Rotterdam
Institute of Housing and Urban Development
Track: Urban Environment, Sustainability and Climate Change

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

الجزء الأول : الحالة الاجتماعية ـ الاقتصادية

المحور الأول : معلومات عامة

7. **الجنس ؟**
☐ ذكر ☐ أنثى
8. **الحالة الإجتماعية ؟**
☐ أعزب ☐ متزوج ☐ منفصل/ة ☐ أرمل/ة
9. **هل لديك أي نوع من الإعاقة ؟**
☐ نعم ☐ لا
10. **الفئة العمرية؟**
☐ أقل من 18 عام ☐ بين 18 و 35 عام ☐ بين 36 و 55 عام ☐ أكبر من 55 عام
11. **عدد الأفراد في المنزل ؟**
☐ من 1 – 3 أشخاص ☐ من 4 -6 أشخاص ☐ 7 أو أكثر
12. **المحافظة ؟**
☐ الشمال ☐ غزة ☐ الوسطى ☐ خانيونس ☐ رفح

المحور الثاني: التعليم ومستوى الوعي بقضية التغير المناخي

4. **المستوى التعليمي ؟**
☐ غير متعلم ☐ تعليم أساسي ☐ تعليم ثانوي ☐ جامعي
5. **عدد الدورات أو التدريبات أو ورش العمل التي حضرتها في مجال التغير المناخي والتكيف معه**
☐ لم أحضر أي تدريب ☐ حضرت (العدد: ----------)
6. **عدد سنوات الخبرة في المجال الزراعي؟ ---------- سنة**

المحور الثالث: عوامل القوة الاجتماعية-الاقتصادية

9. **معدل الدخل المالي الشهري للأسرة ؟**
☐ اقل من 1000 شيكل ☐ بين 1000 و 2000 شيكل
☐ من 2001 الى 3000 شيكل ☐ أكثر من 3000 شيكل
10. **عدد الموظفين في الأسرة؟ ----------**
11. **هل لديك تأمين على الممتلكات؟**
☐ لا ☐ نعم (ما نوعه؟ ----------)
12. **هل تحصل أو حصلت على قروض بنكية لدعم عملك الزراعي؟**
☐ لا ☐ نعم
13. **ملكية الأرض؟**
☐ ملك خاص ☐ مستأجرة ☐ تعمل في أرض يملكها آخرون
14. **مساحة الأرض التي تعمل بها بالدونم؟ ----------**
15. **هل أنت عضو في أي مؤسسة اجتماعية (نقابة، جمعية، تعاونية زراعية.. إلخ)؟**
☐ لا ☐ نعم
16. **هل تحصل على مساعدة مالية من العائلة أو مؤسسات خيرية؟**
☐ لا ☐ نعم

الجزء الثاني: الحالة الاجتماعية ـ السياسية

المحور الأول: مصادر المياه

8. **ما هو مصدر المياه المنزلية التي تستخدمها ؟**
☐ البلدية ☐ آبار المياه ☐ مياه الأمطار ☐ أخرى .....

9. ما هو مصدر مياه الشرب في المنزل ؟

☐ البلدية ☐ آبار المياه ☐ مياه الأمطار ☐ نظام تحلية خاص ☐ شراء المياه

10. كيف تقيّم جودة مياه الشرب لديك في المنزل ؟

☐جيدة جدًّا ☐ جيدة ☐ متوسطة ☐ سيئة ☐ سيئة جدًّا

11. ما هو مصدر المياه لنظام الري ؟

☐البلدية ☐ آبار المياه ☐ مياه الأمطار ☐ مياه الصرف المعالجة ☐ شراء مياه

12. ما هي المسافة بين أرضك الزراعية ومصدر مياه الري؟

☐ أقل من 100 متر ☐ 100-500 متر ☐ أكثر من 500 متر

المحور الثاني: أنظمة الزراعة

2. إلى أي مدى تتفق مع الأنظمة والقوانين التي تنظم قطاع الزراعة ؟

☐متفق جدًّا ☐ متفق ☐ لا أعرف ☐ غير متفق ☐ غير متفق أبدًا

المحور الثالث: الاعتداءات الإسرائيلية

3. كم تقدّر خسائرك المادية نتيجة الاعتداءات الإسرائيلية على قطاع غزة بين عامي 2008-2021 ؟

☐أقل من 10 آلاف دولار ☐ 10-50 ألف دولار ☐ 50-100 ألف دولار

☐ أكثر من 100 ألف دولار

المحور الرابع: تعزيز دور الإناث في العمل الزراعي

3. كم عدد الإناث العاملات في الأرض التي تعمل بها ؟ ----------

4. كم عدد الذكور العاملين في الأرض التي تعمل بها ؟ ----------

الجزء الثالث: القدرة على التكيف مع ظروف المناخ

يرجى اختيار التقييم المناسب أمام كل فقرة مما يلي:

	الفقرة	موافق بشدة	موافق	محايد	غير موافق	غير موافق بشدة
1.1	لديك إمكانيات مالية لمواجهة مخاطر التغير المناخي، وخاصة تذبذب الأمطار والفيضانات وتغيرات الحرارة.					
1.2	لديك إمكانية للوصول إلى الموارد المالية الكافية لتمويل عملك الزراعي (دعم خارجي، قروض.. إلخ).					
	الفقرة	**موافق بشدة**	**موافق**	**محايد**	**غير موافق**	**غير موافق بشدة**
2.1	لديك القدرة على التواصل مباشرة لطلب النجدة من الجهات المعنية والمجتمع المحلي في حال وقوع خطر له علاقة بتغيرات المناخ (من أمثلة الأخطار وقوع فيضان مفاجئ في أوقات المطر الشديد).					
3.1	هناك خدمة كافية للمياه في المنطقة وبمقابل مالي مقبول.					
3.2	هناك خدمة كافية للمواصلات في المنطقة وبمقابل مالي مقبول.					
3.3	هناك خدمة كافية لإمدادات الكهرباء في المنطقة وبمقابل مالي مقبول.					
3.4	يمكنك الحصول على مياه الشرب في حالات وقوع أخطار كالفيضان.					
3.4	تتوفر خدمة طبية قريبة من مكان سكنك.					

4.1	حسب تقديرك، الجهات الحكومية (وزارة الزراعة مثلا) لديها وعي كافٍ بمشكلات وآثار التغير المناخي (خاصة مشكلات تذبذب الأمطار والفيضانات ودرجات الحرارة).					
4.2	حسب تقديرك، المؤسسات الدولية العاملة في قطاع الزراعة لديها وعي كافٍ بمشكلات وآثار التغير المناخي (خاصة مشكلات تذبذب الأمطار والفيضانات ودرجات الحرارة).					
4.3	تشعر أن لديك وعي كافٍ بمشكلات وآثار التغير المناخي (خاصة مشكلات تذبذب الأمطار والفيضانات ودرجات الحرارة).					
4.5	لديك قدرات ومهارات للاستجابة السريعة مع الطوارئ (مثال: الفيضان)، وذلك بناء على تدريبات وورش عمل حضرتها في هذا المجال.					
5.1	حسب تقديرك، مؤسسات المجتمع المدني والمؤسسات العاملة في قطاع الزراعة لديها الرغبة والنية لدعمك في عملية بناء وتعزيز قدرتك على التكيف مع التغيرات المناخية (خصوصا تذبذب الأمطار والفيضانات ودرجات الحرارة).					
5.2	قادة المجتمع المحلي (المخاتير، زعماء العشائر.. إلخ) يتدخلون بشكل سريع ويساعدون في حال وقوع خطر ناجم عن التغير المناخي (مثال: الفيضان).					
5.3	تشعر بأنك تشارك في صناعة القرار والتخطيط لتعزيز التكيف مع تغيرات المناخ، وخاصة مشكلات تذبذب الأمطار والفيضانات والحرارة.					
5.4	الجهات الحكومية (وزارة الزراعة مثلا) لديها خطط طوارئ (وتم تدريبك عليها) للاستجابة لمخاطر تغيرات المناخ (خصوصا تذبذب الأمطار والفيضانات ودرجات الحرارة)					
5.5	مؤسسات المجتمع المدني والمؤسسات الدولية العاملة في قطاع الزراعة لديها خطط طوارئ (وتم تدريبك عليها) للاستجابة لمخاطر تغيرات المناخ (خصوصا تذبذب الأمطار والفيضانات ودرجات الحرارة)					
5.6	تعتقد أن هناك مؤسسات وجمعيات نشطة في المجتمع تأخذ على عاتقها التركيز على مشكلات الزراعة والتغير المناخي.					

Appendix 3: IHS copyright form

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