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College of Management

Department of Risk Management



**Study of The Impacts of Desertification
on Economic aspect in The Kingdom of Saudi
Arabia
(FINAL PROJECT)**

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دراسة آثار التصحر على الجانب الاقتصادي في المملكة
العربية السعودية
(مشروع التخرج)

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Abstract

In the name of God the Merciful

Praise be to Allah, prayers and peace envoy to the mercy to the worlds. and after:

This study that titled Study of The Impacts of Desertification on Economic aspect
in The Kingdom of Saudi Arabia

Aimed at identify the relationship between the desertification and economy in the kingdom of Saudi Arabia. The study adopted the analytical survey approach and consists of 520 Participants from 13 regions in the country.

This research consists of seven chapters that are:

Chapter1: Overview of study/ Introduction (Abstract in both languages, Introduction, Research problem, Research importance and objectives, Research Hypothesis, Research Methodology and Research Limitation)

Chapter2: Theoretical Framework and Literature reviews about the research topic (The impacts of desertification on Economy aspect in The Kingdom of Saudi Arabia)

Chapter3: Research Model & Developing Research Hypotheses that used in the research with full explanation.

Chapter4: Research Methodology which is about the research design, Approach, and the sampling.

Chapter5: Statistical Analysis and Research Findings; this chapter includes a description of the important results, and presented as tables and graphs with an explanation of the results.

Chapter6: Finding discussion

Chapter7: Conclusion, Recommendations, Future Research, also the Summary and References.

- ✧ Educating society about desertification, its effects, and the importance of adhering to available plans to mitigate its effects.
- ✧ Paying attention to educational programs and activities by the competent authorities.
- ✧ Activating the role of volunteerism that contributes to improving the environment.
- ✧ Rain seeding and afforestation are essential in alleviating desertification.

المستخلص

بسم الله الرحمن الرحيم

الحمد لله رب العالمين، والصلاة والسلام على المبعوث رحمة للعالمين. وبعد:

جاءت هذه الدراسة بعنوان دراسة آثار التصحر على الجانب الاقتصادي في المملكة العربية السعودية

وهدفنا الدراسة الى الكشف عن مدى علاقة التصحر واثاره باقتصاد المملكة العربية السعودية واعتمدت الدراسة على المنهج المسحي التحليلي، وتكونت الدراسة من 520 مشارك من جميع المناطق الإدارية بالمملكة العربية السعودية التي عددها 13 منطقة.

تكون الرسالة من سبعة فصول، اشتمل الفصل الأول على المقدمة وأهداف الدراسة ومشكلة الدراسة، واشتمل الفصل الثاني على النظريات التي اعتمدت عليها الدراسة بالإضافة الى الدراسات السابقة، واحتوى الفصل الثالث على الإطار النظري للدراسة، كما اشتمل الفصل الرابع على الإجراءات المنهجية للدراسة وتناول الفصل الخامس المنهجية وخطوات عمل التحليل الإحصائي، بينما الفصل السادس يشمل مناقشة النتائج وتفسيرها، ويأتي في الفصل السابع الأخير الخاتمة وتوصيات الدراسة والدراسات المستقبلية.

بناء على ما تم التوصل إليه من نتائج عن هذه الدراسة يوصى بما يلي:

- ✧ توعية المجتمع عن التصحر والآثار المترتبة عليه وأهمية الالتزام بالخطط المتاحة لتخفيف اثره.
- ✧ الاهتمام بالبرامج والأنشطة التثقيفية من قبل الجهات المختصة.
- ✧ تفعيل دور التطوع المساهم في تحسين البيئة.
- ✧ الاستمطار والتشجير أمان اساسيان في تخفيف التصحر.

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Dedication

First, I like to dedicate the success of the research to my family for always supporting me, for not leaving my side whenever I face hardships and when I feel like giving up, for giving me advice on what should I do.

Second, I also want to dedicate the success of our research paper to my husband who supported me throughout my academic journey. For always giving me hope and for advising me that I should always think positive.

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Chapter 1

(Introduction)

Introduction

The United Nations Convention defines desertification as land degradation in area, semi-arid, and dry sub-humid areas. The definition further recognizes human and climatic variations as the major contributing factors to the phenomenon. According to the existing statistics, drylands cover about 41% of the Earth's surface and support the livelihood of more than 38% of the global population. The United Nations Convention to Combat Desertification estimated that about 36 by 106 km² of land surface was desertification, presenting a major threat to livelihoods (Feng et al., 2019). In the arid and semi-arid regions such as the Middle East and northwestern China. Cheng et al. (2018) argued that desertification affects most dryland countries and still expanding across many parts of the world amidst the rising threats of climate change, population growth, rural poverty, and food security. The UN estimated that drought and desertification cause an estimated annual loss of 120,000 square kilometers of land globally, making it a major problem worth exploring. The continued loss of arable land exposes global population to high poverty due to low productivity.

Land degradation through soil erosion and desertification is a major socio-economic issue that affects both the livelihood and economic conditions of a society. Several studies have attempted to explore the concept and its economic consequences. Salvati, Zitti, and Ceccarelli (2008) identified desertification as a complex phenomenon that reduces soil fertility, lowering economic growth. Tokbergenova, Nyussupova, Arslan, and Kiyassova (2018) also highlighted desertification as one of the major problems affecting societies. According to Malek (2018), an estimated 3.2 billion people across the world experience the negative effects of land degradation. The report also demonstrates that about 143 million people could migrate from their communities due to water scarcity and reduced crop productivity. More reports indicate that about 70 to 90 percent of the population in the Arabian Peninsula is at threat of the adverse effects of desertification. Therefore, it calls for an understanding of some of the economic effects of the phenomenon on the global population. The effects on the socio-economic well-being of communities make it an interesting topic to exploit and establish the effects and some of the mitigation strategies.

Desertification influences the socio-economic and agricultural activities in societies, threatening economic growth and development. It is becoming a major problem in most parts of the world, threatening the long-term sustainability of societies. The degradation of land in arid, semi-arid, and dry sub-humid areas arises from climatic changes and human activities as the main driving forces. Some of the direct factors responsible for desertification are deforestation, water erosion, salinization, and wind erosion. It results in a significant loss of biodiversity that depends on the land and water resources for their livelihood. The economic consequences of these practices extent to different sectors including agriculture, tourism, and international trade, which are critical components of economic growth .

The Kingdom of Saudi Arabia (KSA) is one of Middle Eastern countries with increasing desertification. According to Malek (2018), arable land in these regions is increasingly turning into deserts threatening the livelihood of the population. It affects food security, socioeconomic stability, economic development, and biodiversity. Current reports highlight KSA as a predominantly arid and semi-arid country with no rivers while the daily per capita water use remains high (Sayl et al., 2021). The low vegetation cover in the country exposes it to more climate change problems, further threatening the population's well-being. Therefore, based on the significant desertification risks in the KSA, the study will exploit

some of the potential economic consequences of the phenomenon that inform the mitigation strategies at different governance levels .

One of the main motivations of exploring the topic is the significant increase in desertification in KSA over the past three decades. The economic consequences also make it an interesting area to examine. Desertification also creates water shortages hindering proper agriculture, particularly in the gulf. It is also a threat to sustainable tourism and economic development in these countries. Climatic conditions such as reduced precipitation, increased temperature, and drought are some of the major causes of desertification in areas with forests, grasslands, and sparse vegetation (Alrwis et al., 2021). The overall significant decline in precipitation and increased temperature arises from the increased carbon emissions that result in global warming and climate (Sayl et al., 2021). It creates unpredictable weather patterns that encourage drought and desertification in these areas. Desertification exposes land to significant economic and environmental damages (Tokbergenova et al., 2018). Reduced crop yields, pasture productivity, and decline in livestock and export potential of agriculture (Tokbergenova et al., 2018). Although countries such as the KSA hardly engage in agriculture, desertification is a major threat to reduced economic prosperity in other areas such as tourism (Alrwis et al., 2021). The reduced crop and livestock yield implies that the country will record a significant fall in agricultural exports (Alrwis et al., 2021).

The main issue that the study will address is the economic impact of desertification in the KSA. Over the past three decades, KSA has experienced a significant deterioration of arable land through land degradation processes such as soil erosion and desertification. Coupled with the effects of climate change, desertification is presenting a significant impact on the country's economic wellbeing. From reduced agricultural productivity to disruption of biodiversity, that affects tourism, uncontrolled desertification could threaten the economic stability of the country. Although KSA is heavily dependent on oil and natural gas resources, the depletion of these resources in future may require a shift in focus to agriculture and tourism. However, this may come at a time when the country's arable land is depleted due to desertification. The research will address the economic impact of desertification in KSA. The sub-problems that the study will seek to address will include the extent to which desertification is affecting agriculture, tourism and international trade, as major export components .

The study will also address some of the underlying drivers of desertification in the KSA such as soil erosion, climate change, and saltation. My research will focus on how human and economic activities such as urbanization and exploration of natural gas and oil in KSA is contributing to desertification. Based on the drivers, the study will also examine the extent to which the current mitigation and adaptation approaches are effective in addressing the problem. The KSA government is adopting mechanisms to combat the growing desertification in the country and curb some of the adverse economic consequences. The research will propose more strategies that the government and other stakeholders could adopt to promote resilience .

The increasing desertification in KSA is posing a significant economic threat to the country. From reduced agricultural productivity to declining tourism, it could significantly affect the economic competitiveness of the country in the region. An examination of the economic impacts will be significant in understanding the extent to which desertification could threaten the GDP growth and global economic competitiveness. The study will also make significant contribution towards the growing literature on economic consequences of

desertification. Although there have been past attempts to examine the economic effects of desertification, few of these studies have focused on the KSA. The research will add to the general science field of land degradation and related processes such as climate change and soil erosion. The topic is more relevant at this time when climate change concerns are occupying global research space and governments seeking ways of protecting their resources.

Research problem

Based on the introduction, the research problem of interest in the current study will be that there are significant impacts of desertification on various aspects of the KSA with the main being its economy. Research on the economic consequences of desertification in arid areas such as the KSA remains inconclusive. While desertification will increase erosion and drought, the economic consequences such as reduced GDP growth, increased unemployment rates, and reduced exports remain inconclusive. Most of the existing studies focus on the indirect social influence of desertification on economies with little attention to economic factors. The study will address this gap by exploring some of the economic influences such as reduced agricultural productivity, increased unemployment rates, reduced export value, and low GDP among other key economic indicators related to agriculture. The study will extend the existing research to explore some of the economic consequences of the phenomenon and the mitigation strategies that the KSA government could adopt to limit the effects on its economic progress.

Research Questions

Question:

What are the economic impacts of desertification in the Kingdom of Saudi Arabia? And how does it affect local and global economies?

Sub-Questions:

- What are some sectors of how desertification has impacted local economies?
- How does desertification affect regional economies and tourism sectors?
- What are the underlying drivers of desertification? And how to evaluate the effectiveness of current mitigation and adaptation approaches?
- What are the recommended sustainable strategies for combating desertification and promoting resilience in affected regions?

Research Objectives

The study will make an important contribution to the growing research on the effects of desertification. While most of the existing studies have focused on the social and health impact, there is a gap in the economic effects. The research will identify some of the direct and indirect economic consequences, informing the sustainable strategies the KSA government could adopt to mitigate it and promote resilience in the affected areas. The study will also be important in understanding the underlying drivers of desertification and evaluating the effectiveness of the existing adaptation and mitigation approaches. The findings will help various government stakeholders to understand the weaknesses of the existing mitigation strategies and formulate the best techniques that yield the desired outcomes. The research will focus on addressing the following specific research objectives.

1. To analyze the economic harmful points of desertification, including effects on regional economies and tourism sectors.
2. To identify the underlying drivers of desertification and evaluate the effectiveness of current mitigation and adaptation approaches.
3. To propose sustainable strategies for combating desertification and promoting resilience in affected regions.

Research Hypotheses

- **Null hypothesis:** There is no significant relationship between desertification and the country's economy.
- **Alternative hypothesis:** There is a significant relationship between desertification and the country's economy.

Based on the hypothesis, the research will involve economic conditions (GDP growth, GDP, unemployment rates) as the dependent variable while the desertification measures such as percentage of dryland cover will be the independent variable. A correlational and t-test will help establish the type and strength of relationship between the variables.

Research Limitations

One of the major limitations that may arise during the research is limited publications on the topic of desertification and its economic influence. The economic impact of desertification is a new area of research with most of the past studies focusing on the indirect effects. The limited secondary publications may limit an understanding of the concept. It will limit the number of studies reviewed in the qualitative research,

resulting in inconclusive results since it is an ongoing area of research. Moreover, the sample period of 10 years may also be a limitation in the current research because of limited data. Desertification is a continuing phenomenon with growing statistics. The focus on the specific period between 2012 and 2022 may leave out important data outside of the sample frame, negatively affecting the validity and reliability of the findings from the study. Finally, the study objectives may also limit the scope of the research. Although it is good to have a narrow view of the subject, it presents the risk of ignoring other important factors that directly contribute to desertification.

Structure Research Proposed

The research will include seven chapters that are:

Chapter1: Overview of study/ Introduction (Abstract in both languages, Introduction, Research problem, Research importance and objectives, Research Hypothesis, Research Methodology and Research Limitation)

Chapter2: Theoretical Framework and Literature reviews about the research topic (The impacts of desertification on Economy aspect in The Kingdom of Saudi Arabia)

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Chapter6: Finding discussion

Chapter7: Conclusion, Recommendations, Future Research, also the Summary and References.

Timeline

Task	Project Team selection	Topic Selection	Feedback by Supervisor (Topic)	Writing Proposal	Proposal Feedback by Supervisor	Preparing Final
Week1	Decide to make Individual Project and Submit the details on 30-09-2023					
Week2						
Week3		Submit the topic on	Received the feedback on 25-10-2023			
Week4						
Week5						
Week6				Work on Proposal and Submit it on (09-11-2023)	Receiving and Approval for Project Plan (21-11-2023)	
Week7						Follow up on theoretical content and the practical application of Research
Week8						
Week9						
Week10						
Week11						
Week12						The Submission is between (09-12-2023&22-12-2023)

Table 1 Timeline

Chapter 2

(Theoretical Framework)

Literature review

Major Drivers of Desertification

Desertification remains a major ecological and environmental problem in most parts of the world. Various scholars have explored the concept of desertification, its driving factors, mitigation measures, and socio-economic impact on societies. Jiang et al. (2019) identified human and climatic factors as the major drivers of desertification. According to the authors, climatic conditions such as reduced precipitation, increased temperature, and drought are some of the major causes of desertification in areas with forests, grasslands, and sparse vegetation. The overall significant decline in precipitation and increased temperature arise from the increased carbon emissions that result in global warming and climate. It creates unpredictable weather patterns that encourage drought and desertification in these areas. However, in areas with sparse vegetation, Jiang et al. (2019) argued that human activities were the major drivers of desertification. In regions such as Central Asia and the Middle East where there is significant exploration of oil and natural gas, there are major activities geared towards resource exploitation, resulting in damage to existing vegetation.

According to Kirkby (2021), climate change and global warming will continue to increase aridity in most parts of the world. Climate change will result in low rainfall, intensifying abandonment of farmland and threatening afforestation (Kirkby, 2021). The author argued that human activities are continuously modifying climate change, threatening environmental sustainability. Kirkby (2021) further introduced the concept of land desertion as a cause of desertification and climate change. According to the author, the perception of greater prosperity in other regions makes people migrate, increasing competition for scarce resources and encouraging encroachment into productive lands. The migration pressure due to expanding arid and semi-arid lands threatens environmental sustainability as households encroach into forests, resulting in deforestation and desertification. Jiang et al. (2019) also identified large-scale human migrations and free markets converting to planned economies can lead to desertification. The authors also viewed human activities from the perspectives of changes in agricultural practices and anthropogenic disturbances. Changes such as the expansion of irrigated agriculture often lead to shrinking lakes and increased irrigation water (Jiang et al., 2019). Besides, the abandonment of distant pastures, the collapse of animal husbandry, and the abandonment of extensive croplands are also changes in human lifestyles that are making major contributions toward desertification (Jiang et al., 2019).

Han, Wang, Chen, Xiang, Ling, Li, and Wang (2021) also analyzed the driving factors of desertification using a geographic detector model. Some of the driving forces identified in the study include meteorological, human, and environmental. According to Han et al. (2021), meteorological factors such as evaporation, temperature changes, wind speed, and precipitation cause significant effects on desertification. Increased temperatures and reduced precipitation due to climate change result in reduced rainfall that causes desertification. Han et al. (2021) argued that these climatic conditions result in sparse vegetation, especially in basin areas, making desertification control a challenge. Although increased temperature triggers high precipitation, it has negative effects in arid and semi-arid regions. Moreover, Han et al. (2021) highlighted topographical factors such as distance from water sources and soil as major contributors to desertification as they influence vegetation distribution. Finally, other human activities such as excessive reclamation, overgrazing, and extensive resource development through mining and exploration of oil and gas will have a major impact on vegetation.

These studies cover important aspects of contributing factors to desertification, which will help identify the underlying drivers of desertification and the effectiveness of current mitigation and adaptation approaches, which is one of the objectives addressed in the current study. My research will expand on the driving forces identified in past studies, focusing more on human and climatic factors.

Economic Impact of Desertification

Desertification presents major economic consequences that if left unchecked could threaten the economic sustainability of societies. These effects extend to various sectors of the economy such as agriculture and tourism, negatively affecting the economic growth of societies. Cheng, Lu, Wu, Yin, Bao, and Gong (2018) discussed some of the costs of desertification in China. According to the authors, it lowers economic growth due to the reduction in land productivity. The declining agricultural productivity implies that society will not sustain its needs, lowering nutritional levels and increasing poverty rates (Cheng et al., 2018). From loss of arable land area to loss of plant nutrients and soil organic carbon, and reduction in effective rooting depth, the decline in agricultural productivity will hinder economic growth for societies that heavily depend on agriculture.

Desertification increases the susceptibility of arable land to soil erosion, significantly causing poor economic growth (Cheng et al., 2018). In an estimate of the economic loss of desertification in China, Cheng et al. (2018) reported that the country loses about CNY 54.1

annually. Economically, reduced agricultural productivity results in low GDP. Governments may also increase their investments in productive alternatives, shifting focus from other areas that could drive overall economic growth (Albati, 2023). According to scholars, the indirect costs of desertification may include damage to human health by sand-dust storms and property. For example, they estimated the cost of siltation at CNY 1,639 million for river courses and CNY 500 for reservoirs. It may generate major costs associated with transportation due to damages to railway and highway facilities. The costs and financial losses due to desertification present major economic consequences to communities and governments.

Tokbergenova, Nyussupova, Arslan, and Kiyassova (2018) identified erosion as one of the most dangerous forms of land degradation, resulting in soil destruction and blowing off the top layer of productive agricultural land. Desertification exposes land to significant economic and environmental damages (Tokbergenova et al., 2018). According to the authors, reduced crop yields, pasture productivity, and decline in livestock and export potential of agriculture (Tokbergenova et al., 2018). Although countries such as the KSA hardly engage in agriculture, desertification is a major threat to reduced economic prosperity in other areas such as tourism. The reduced crop and livestock yield implies that the country will record a significant fall in agricultural exports. The effect is the overall economic progress of a country. Desertification causes water shortages through the cessation of flooding and lowering of groundwater levels. The increased saline land area also lowers livestock productivity per capita. Since agriculture is a major export component for some countries, it results in negative economic impact and poor living conditions of a population. Tokbergenova et al. (2018) further state that there is an increasing reorientation of farms, negatively affecting the economic growth of emerging economies.

In a study of the impact of climate change on desertification, Albati (2023) argues that it significantly affects economic activities with some of the most arid areas recording significant decline in investors and tourism. These countries have reported notable economic growth and the exploitation of the resources. From water shortages to damage to agricultural land, the deterioration of agricultural land yield significant economic consequences that lowers the GDP. The reduction in productive land implies that few people will get employment in agricultural lands. The effect is high unemployment rates that trigger poor economic progress in a country.

Desertification also presents major economic effects on the tourist sector. In countries that rely on tourism as a major source of GDP, desertification will have a major effect on the tourist destination. An increase in desertification threatens the existence of biodiversity of flora and

fauna, which are major tourism resources. Besides, it also has a direct impact on water levels and snowpack, making a country less attractive to tourists. Forests will suffer the direct negative effects of tourism through deforestation. The loss of flora and fauna lowers the contribution of the tourism sector towards economic development. It may also hinder the effective exploitation of oil and natural gas in countries such as Saudi Arabia, which is heavily dependent on resources for economic progress. The reduction in oil exploitation due to desertification will result in a significant fall in the overall GDP of a country.

In the first part of the 20th century, KSA engaged in extensive oil exploration that encouraged urban development and population increase. The increased urbanization intensified land degradation in rural Saudi Arabia (Barth, 1999). According to Barth (1999), desertification led to a drastic reduction of species diversity, negatively affecting tourism, which was a major source of government revenue in the KSA. Salih, Hassaballa and Ganawa (2021) argued that desertification has significantly affected the Al-Ahsa Oasis that is dominated by date palms. As a main source of income for local farmers, the reduction in date palms in the region due to desertification negatively affects the economic status of the population. Murshed (2022) argued that desertification in the KSA reduces the country's agricultural output, resulting in slow economic growth.

Strategies for Combating Desertification

Qi et al. (2020) identified government leadership, technological support, and legislation as some of the common ways of combating desertification. The authors recommended the establishment of control policies and systems for the safety of biological and geographical safety. The government also plays an important role in formulating national actions that protect and restore ecological environments for sustainable economic growth. The legal protection of natural resources is a function of good governance leadership (Feng et al., 2019). Afforestation is yet another strategy that could help countries protect their biodiversity and generate notable economic benefits. Through afforestation, a country increases the percentage of land under plant cover, resulting in increased rainfall and moderate temperatures that support agricultural productivity (Feng et al., 2019). Increased plant cover also implies a high attractiveness of biodiversity, encouraging tourism. Feng et al. (2019) proposed the fencing of grassland to prevent grazing and exclude livestock. The approach protects arable farmland from excessive erosion that leads to degradation and negative effects such as climate change and reduced agricultural productivity. Barth (1999) recommended

education and community involvement as necessary processes in limiting degradation and its effects on the KSA's economy.

Research Variables:

In the study of The Impacts of Desertification on Economic aspect in The Kingdom of Saudi Arabia that will involve economic conditions (GDP growth, GDP, unemployment rates) as the dependent variable while the desertification will be the independent variable and Human activities and climatic factors as mediator variables.

Chapter 3

(Research Model& Developing Research Hypotheses)

The Impacts of Desertification on Economic aspect in The Kingdom of Saudi

Desertification and economic growth in Saudi Arabia are two interconnected issues that have received significant attention in recent years. Saudi Arabia, located mainly within the arid Arabian Desert, faces challenges related to desertification, which is the process of land degradation in dry areas, leading to the expansion of desert-like conditions.

Desertification poses several environmental and socio-economic consequences in Saudi Arabia. The country's limited water resources are under constant pressure due to desertification, as the process leads to increased soil erosion and reduced water infiltration, making it difficult for vegetation to survive. This, in turn, affects agricultural productivity and poses challenges for food security.

However, despite these challenges, Saudi Arabia has experienced remarkable economic growth over the past few decades. The country has taken advantage of its abundant oil reserves and has been a leading oil producer and exporter for many years. Oil exports have fuelled economic development, infrastructure projects, and the creation of various industries. This has resulted in significant urbanization and industrialization, particularly in cities such as Riyadh, Jeddah, and Dammam.

To address the issue of desertification and promote sustainable economic growth, Saudi Arabia has implemented several initiatives and strategies. One notable example is the "Saudi Vision 2030," announced in 2016, which aims to diversify the country's economy and reduce its dependence on oil. The vision emphasizes the importance of environmental sustainability and includes plans for renewable energy development, water conservation, and the promotion of sustainable agriculture practices.

Additionally, Saudi Arabia has invested in large-scale agricultural projects, such as the Al-Jouf Agricultural Development Company and the King Abdullah Initiative for Saudi Agricultural Investment Abroad. These projects aim to increase domestic food production and reduce the reliance on food imports, which would help mitigate the environmental impact of desertification.

Furthermore, the Kingdom has implemented reforestation and afforestation programs to combat desertification. For instance, the "Green Saudi Initiative" and the "Green Middle East Initiative" were launched in 2021, with the goal of planting billions of trees across the country and the wider region.

In conclusion, desertification poses environmental challenges for Saudi Arabia, including limited water resources and reduced agricultural productivity. However, the country has experienced significant economic growth in recent decades, mainly driven by oil exports. To address desertification and promote sustainable economic growth, Saudi Arabia has implemented initiatives such as Saudi Vision 2030, renewable energy projects, and large-scale agricultural investments. Additionally, reforestation and afforestation programs are being undertaken to combat desertification and mitigate its environmental impact.

The desertification affects local, regional, and global economies GDP growth, GDP, employment rate:

Desertification that is the process of land degradation in arid and semi-arid regions, has significant implications for both local and global economies. As desertification progresses, it poses numerous socio-economic challenges, including the decline in agricultural productivity, increased food insecurity, loss of livelihoods, and heightened economic vulnerability. This article explores the multifaceted impact of desertification on the local and global economies, as well as its influence on the employment rate in Saudi Arabia.

Impact on Local Economies:

1. **Agricultural Productivity Decline:** Desertification severely affects agricultural lands, leading to reduced soil fertility, water scarcity, and limited vegetation growth. In Saudi Arabia, where agriculture heavily relies on irrigation, desertification puts additional strain on water resources, hampering crop yields and agricultural productivity. This decline in agricultural output not only affects food security but also disrupts the local economy, as agriculture contributes to employment, income generation, and rural development.
2. **Increased Economic Vulnerability:** Desertification in Saudi Arabia contributes to economic vulnerability, especially in rural areas heavily dependent on agriculture and natural resources. As arable land diminishes and grazing areas shrink, farmers and herders face challenges in sustaining their livelihoods. This leads to increased poverty rates, economic instability, and reliance on external sources for food and income.
3. **Water Shortages and Increased Costs:** Desertification exacerbates water scarcity in Saudi Arabia, where water resources are already limited. The need for irrigation to sustain agriculture and support human settlements places significant pressure on water supplies. As water becomes scarcer, the cost of water rises, affecting agricultural production costs and the overall economy. Industries and businesses that rely on water resources, such as manufacturing and tourism, may also face challenges and increased operating costs.
4. **Impact on Energy Sector:** Saudi Arabia's economy heavily relies on oil production and export. Desertification can indirectly impact the energy sector by affecting infrastructure, such as pipelines and transportation routes. Additionally, dust storms associated with desertification can pose challenges to oil extraction and refining processes, leading to increased maintenance costs and potential disruptions in production.

Impact on Global Economies:

1. **Oil Prices and Global Energy Markets:** As one of the world's leading oil producers, any disruption in Saudi Arabia's oil production due to desertification or associated factors can have global implications. Reduced oil production or increased costs can affect global energy markets, leading to higher oil prices and impacting industries and economies worldwide.
2. **Food Security and Imports:** Desertification in Saudi Arabia can impact global food security as the country relies heavily on food imports. If local agricultural productivity declines due to desertification, Saudi Arabia may increase its reliance on imports, affecting global food markets and prices. This can have significant economic consequences, particularly for countries dependent on food exports.

Employment Rate:

1. **Agricultural Job Losses:** Desertification's impact on agricultural productivity directly affects employment rates in the agricultural sector. As farm yields decline and farming becomes less viable, farmers and agricultural workers may face job losses or reduced income opportunities. This can lead to rural-urban migration and increased unemployment rates.
2. **Economic Diversification and Job Creation:** To combat the impact of desertification, Saudi Arabia has emphasized economic diversification through initiatives such as Vision 2030. This initiative aims to reduce the country's dependence on oil and create new industries and employment opportunities in sectors such as renewable energy, tourism, and technology. By promoting sustainable economic growth, these efforts can help mitigate the negative employment effects of desertification.

Sectors affected by Desertification

Desertification in Saudi Arabia can have significant impacts on various sectors of the economy. Here is a list of sectors that can be affected by desertification:

1. **Agriculture:** Desertification poses a significant threat to agricultural productivity in Saudi Arabia. It can lead to soil degradation, reduced water availability, and loss of arable land. Crop yields may decline, and farmers may face challenges in sustaining agricultural activities.
2. **Water Resources:** Desertification can affect water resources, including groundwater and surface water bodies. As desertification progresses, there can be increased water scarcity and reduced water quality. This can impact water availability for domestic, agricultural, and industrial purposes.
3. **Livestock and Pastoralism:** The expansion of desert-like conditions can impact livestock rearing and pastoralism. Reduced grazing land and limited water sources can affect the livelihoods of pastoral communities and the productivity of livestock farming.
4. **Biodiversity and Ecosystems:** Desertification can lead to habitat degradation and loss, impacting biodiversity and ecological balance. Native flora and fauna may struggle to survive in degraded environments, affecting ecosystem services and disrupting ecological processes.
5. **Infrastructure:** Infrastructure, such as roads, buildings, and pipelines, can be affected by desertification. Wind erosion and sand encroachment on infrastructure can lead to damage, maintenance costs, and disruptions in transportation and communication networks.
6. **Tourism:** Saudi Arabia has significant tourism potential, including attractions such as historical sites, natural landscapes, and cultural heritage. Desertification-induced degradation of these attractions can impact tourism revenue, visitor experiences, and the overall tourism industry.
7. **Energy Resources:** Desertification can affect energy resources, particularly in regions where renewable energy projects, such as solar and wind farms, are located. Dust and sand accumulation on solar panels or wind turbines can reduce energy generation efficiency.
8. **Human Settlements:** Desertification can impact human settlements, especially in rural areas dependent on agriculture and natural resources. Population displacement and

migration can occur as livelihoods become unsustainable, leading to social and economic challenges.

9. Public Health: Desertification can have implications for public health. Dust storms associated with desertification can worsen air quality, leading to respiratory problems and other health issues. Reduced access to clean water can also contribute to health risks.

It is important to note that the extent and severity of impacts on these sectors can vary depending on the specific location and the degree of desertification in the country. Understanding these sectoral impacts is crucial for developing effective strategies to mitigate and adapt to desertification in Saudi Arabia.

Majors Drivers of Desertification (Human activities and climatic factors)

Desertification in Saudi Arabia is influenced by a combination of human activities and climate change. As one of the world's driest countries, Saudi Arabia faces significant challenges in combating land degradation and the expansion of desert-like conditions. This article examines the effects of human activities and climate change on desertification in Saudi Arabia, highlighting their implications for the environment and local communities.

1. Loss of Vegetation Cover: activities, such as unsustainable agriculture practices, deforestation, and overgrazing, contribute to the loss of vegetation cover in Saudi Arabia. Unsustainable agricultural practices, including the cultivation of water-intensive crops and inefficient irrigation techniques, deplete water resources, reduce soil moisture, and inhibit plant growth. Deforestation for agricultural expansion and urbanization disrupts natural ecosystems, decreases biodiversity, and removes vital vegetation cover. Overgrazing by livestock leads to the degradation of rangelands, further exacerbating the loss of vegetation cover. The resulting lack of plant life reduces soil stability, increases soil erosion, and accelerates desertification.

2. Soil Degradation and Erosion: activities and climate change contribute to soil degradation and erosion in Saudi Arabia. Unsustainable agricultural practices, such as improper land management and overuse of fertilizers, degrade soil quality, reduce fertility, and increase susceptibility to erosion. Overgrazing and deforestation expose soil to wind and water erosion. Climate change amplifies these effects, as increased aridity, shifting precipitation patterns, and extreme weather events like droughts and storms intensify soil degradation and erosion. The loss of topsoil due to erosion affects agricultural productivity, reduces water-holding capacity, and exacerbates desertification.

3. Depletion of Water Resources: Overexploitation of water resources is a significant consequence of human activities in Saudi Arabia. The country faces water scarcity due to limited freshwater sources and high demand from agriculture, industry, and domestic use. Excessive pumping of groundwater for irrigation and other purposes leads to the depletion of aquifers, lowered water tables, and reduced soil moisture levels. This depletion of water resources decreases the availability of water for plant growth, reduces vegetation cover, and accelerates desertification. Moreover, the extraction of water from rivers and other

freshwater bodies disrupts natural ecosystems and further contributes to the degradation of land and water resources.

4. Increased Frequency and Intensity of Sand and Dust Storms:

Climate change has the potential to increase the frequency and intensity of sand and dust storms in Saudi Arabia. Rising temperatures and changing weather patterns influence wind patterns and aridity, leading to more frequent and severe sand and dust storms. These storms transport large amounts of sand and dust particles, which settle on agricultural lands, urban areas, and infrastructure. The deposition of these particles reduces soil fertility, damages crops, hampers visibility, affects human health, and exacerbates desertification.

5. Disruption of Ecosystems and Biodiversity: activities and climate change disrupt ecosystems and threaten biodiversity in Saudi Arabia. Deforestation, urbanization, and habitat destruction result in the loss of native plant and animal species, reducing biodiversity and disrupting ecological balance. The loss of vegetation cover and the degradation of ecosystems affect soil health, reduce the availability of food and shelter for wildlife, and contribute to desertification. Climate change further exacerbates these effects, as species face challenges in adapting to changing environmental conditions.

6. Impacts on Local Communities: Desertification has significant impacts on local communities in Saudi Arabia. Agricultural communities heavily reliant on natural resources for their livelihoods face reduced crop yields, loss of grazing lands, and increased vulnerability to food and water insecurity. The degradation of land and water resources can lead to rural-to-urban migration as communities struggle to sustain their livelihoods. Additionally, sand and dust storms pose health risks, affecting respiratory health and causing discomfort for residents, particularly in urban areas.

Generally, the effects of human activities and climate change on desertification in Saudi Arabia are substantial. The loss of vegetation cover, soil degradation and erosion, depletion of water resources, increased frequency of sand and dust storms, disruption of ecosystems and biodiversity, and impacts on local communities are all significant consequences. Addressing desertification requires sustainable land management practices, efficient water use, reforestation and afforestation efforts, and measures to mitigate climate change. It is crucial to promote awareness, develop policies, and implement strategies that prioritize the conservation and sustainable use of natural resources to combat desertification in Saudi Arabia effectively. By addressing these effects, Saudi Arabia can work towards preserving its environment, protecting livelihoods, and ensuring the long-term sustainability of its land and communities.

Strategies for Combating Desertification

Saudi Arabia has implemented several strategies and initiatives to combat desertification and promote sustainable land management. Here are some specific examples:

1. **Afforestation and Reforestation:** The Kingdom has launched ambitious tree-planting initiatives, such as the "Green Saudi Initiative" and the "Green Middle East Initiative." These initiatives aim to plant billions of trees across the country and the wider region, including the establishment of the Green Belt project that stretches across 7,000 kilometres from the Red Sea coast to the Arabian Gulf.
2. **Sustainable Agriculture Practices:** Saudi Arabia has invested in sustainable agriculture practices to conserve water resources and improve agricultural productivity. The use of modern irrigation techniques, such as drip irrigation and precision agriculture, has been encouraged to minimize water consumption and increase efficiency. The country has also introduced advanced farming technologies, such as hydroponics and vertical farming, to reduce the reliance on traditional soil-based farming methods.
3. **Water Conservation:** Given the scarcity of water resources, Saudi Arabia has implemented various water conservation measures. These include the use of desalination technologies to produce freshwater from seawater, the adoption of wastewater treatment and reuse systems, and the promotion of efficient water management practices in agriculture, industry, and households.
4. **Land Rehabilitation and Conservation:** The Kingdom has undertaken land rehabilitation projects to restore degraded areas and protect fragile ecosystems. This involves measures like soil conservation, erosion control, and the establishment of protected areas and nature reserves to preserve biodiversity and promote sustainable land use.
5. **Education and Awareness:** Saudi Arabia recognizes the importance of education and raising awareness about desertification and sustainable land management. The government has implemented educational programs, campaigns, and workshops to inform and engage the public, farmers, and local communities in sustainable practices and the preservation of natural resources.
6. **International Collaboration:** Saudi Arabia actively participates in international forums and collaborations to address desertification. The country is a signatory to the United Nations Convention to Combat Desertification (UNCCD) and works with international organizations and partners to share knowledge, exchange best practices, and implement joint projects to combat desertification at a global level.

These strategies and initiatives demonstrate Saudi Arabia's commitment to combating desertification and promoting sustainable land management practices. By combining afforestation, sustainable agriculture, water conservation, land rehabilitation, education, and international collaboration, the country aims to mitigate the environmental impact of desertification and ensure long-term economic and environmental sustainability.

Chapter 4

(Research Methodology)

Introduction

In the previous chapters, we presented the theoretical framework of the study, but the results of research and studies depend on the field procedural steps taken by the study. It can be said that the success of the study depends on the results of the field study due to the moving from the theoretical framework to the practical applied framework.

The importance of this stage that is answering the questions of the study raised and achieve the research objectives based on scientific and societal foundations.

Therefore, in this chapter, we discuss the steps and procedures of the field study, such as stating the research methodology, Data collection approach, tools and technique, Research Population and sample, Validity and Reliability of Questionnaire, and Data Analysis Techniques that were used in processing and analysing the data, as follows:

Research Methodology

In testing the hypothesis of whether a significant relationship exists between desertification and Saudi Arabia's economy, the research will use a mixed research design. The research design will involve both Historical and Descriptive research methods. Under the historical research methods, the study will utilize past literature published about the economic consequences of desertification. The research will focus on the literature published within the last 10 years to help understand other authors' arguments on the topic. The qualitative research method will also involve a review of the literature to help readers understand the concept of desertification, economic consequences, key drivers, effectiveness of the current mitigation strategies, and the most sustainable strategies that can help modern societies become resilient towards the phenomenon.

The research will employ descriptive and correlational designs to test the relationship between desertification and KSA's economic condition or growth. A t-test will also help establish the statistical significance of the relationship .

Lastly, the research type is Deductive Reasoning due to the research is quantitative research and about Hypothesis testing:

Null hypothesis: There is no significant relationship between desertification and the country's economy.

Alternative hypothesis: There is a significant relationship between desertification and the country's economy.

The process of Deductive type as we follow in the research that are: conduct the theory, then the hypothesis, collect data and write the findings, see if the hypotheses confirmed or rejected and review the theory.

Data collection Approach

Quantitative research involves the systematic collection and analysis of data to test hypotheses, examine patterns, and establish relationships between independent variable (Desertification), dependent variable (KSA's economy) and mediators variables (. It aims to quantify and generalize findings to a larger population.

Data collection tool

The research will rely on Primary sources as the original data for the research objectives (Questionnaire) to support the theoretical framework by the practical applied for answering the research questions and achieving the objectives

The questionnaire is designed to contain a set of questions that support the topic of the study through their direct connections to the objectives of the studies and their inquiries.

The questionnaire includes three parts, which are:

The first part: It contains questions related to personal information such as

(Name - Gender - Age - Educational Level – Province)

The second part: It includes the study tool, which relates to the relationship between the desertification and KSA's economy and their relationship with other mediators.

(There are 10 Questions which are Closed-end Questions)

We used Likert scale (Strongly disagree – Disagree – Neither/Nor Agree – Agree – Strongly agree) to measure respondents' attitudes by asking the extent to which they disagree or neither agree nor disagree or agree with a particular question.

The third part: It consists (1) questions that is open-end Question for the respondents' opinions about the recommended strategies to eliminate and reduce the effects of desertification.

Research Population

All Saudi employees (Male-Female) from selected sector (Agriculture sector) that is the worst affected by desertification based on the previous studies, in any of (13) Provinces of Saudi Arabia which are: Makkah, Madina, Riyadh, Eastern, Asir, Najran, Al Bahah, Jazan, Hail, Aljouf, Tabuk, Al Qassim and Northern border.

Research Sample

Probability Sampling (Simple Random Sampling)

For the survey will use a simple Random sample to ensure every employee from the selected population has an equal chance of being selected for filling the survey. Moreover, the simple random sampling helps to ensure that the sample represents the larger population accurately, and allows for the statistical methods to make inferences about the population based on the characteristics observed in the sample. Overall, simple random sampling is a widely used sampling method in surveys because it provides a fair and unbiased approach to selecting a representative sample from a population, allowing for valid generalizations and statistical inferences.

We distributed (615) questionnaires to respondents of the research population, there are (95) questionnaires were excluded because they were not suitable for analysis. Accordingly, the number of questionnaires completed and ready for analysis became (520) questionnaires. In chapter 5 will provide the process for analysing and in chapter 6 will discuss more about the questionnaire and the research sample.

Validity

We relied on two methods to verify the validity of the tool: the first is called face validity, which depends on presenting the tool to a group of specialists who are experts in the field, while the second is called internal consistency and is based on calculating the correlation coefficient between the tool and each unit of the tool. Below are the steps that followed to verify the validity of the tool according to each of the two methods:

First method (Face Validity)

The research tool was presented to three experts and specialists and they were asked to check the tool and express their opinions on it in terms of: the suitability of the paragraphs and their achievement of research objectives, its comprehensiveness, the diversity of its content, and to evaluate the level of linguistic formulation and production, and any comments they deem appropriate regarding modification or delete. They provided valuable comments that benefited the research, influenced on the tool, and assisted produce it well. Thus, the tool has achieved what is called face or logical validity.

Second method (Internal validity)

Since the validity in the measurement literature means that the test is consistent with itself in measuring the aspect it was built to measure, that is, it indicates the extent of the consistency of the scores in the event of repeating the experiment.

Therefore, validity depends - in one of its ways - by using Exploratory Factor Analysis that is one of common method of multivariate research technique, and It will be applied in SPSS.

The main four steps for EFA:

1ST step: the correlation matrix for all variables

2nd step: Factor Extraction

3rd step: Factor Rotation

4th step: make final decision

Reliability

To verify the reliability of the questionnaire, we used the Cronbach Alpha equation.

More details will be in chapter 5 and 6.

Data Analysis Techniques

In addition to what was previously used for data collection tool, such as the Pearson Product-moment correlation coefficient and the Cronbach Alpha coefficient.

The following statistical methods were used to analyse the data collected by applying the questionnaire on the research sample:

- (a) Frequencies and percentages to describe the research population in relation to general information.
- (b) Descriptive Statistics by **Crosstabs**
- (c) Normality Test
- (d) Skewness and Kurtosis
- (e) Multicollinearity Test
- (f) Variance Inflation Factor
- (g) Pearson Correlation
- (h) Linear Regression
- (i) Kaiser–Meyer–Olkin (KMO) and Bartlett of Sphericity Tests
- (j) Using Likert Scale to measuring the agreement and frequencies, the values (weights) were calculated as in the following table:

Likert-Scale Description	Weight/value
Strongly disagree	1
Disagree	2
Neither/Nor Agree	3
Agree	4
Strongly agree	5

Table 2 Likert-Scale weights

Then the direction is determined for the scale as in the following table:

Likert-Scale Description	Likert-Scale Interval
Strongly disagree	1.00 to 1.80
Disagree	1.81 to 2.60
Neither/Nor Agree	2.61 to 3.40
Agree	3.41 to 4.20
Strongly agree	4.21 to 5.00

Table 3 Likert-Scale Interval

Chapter 5

(Statistical Analysis & Research Findings)

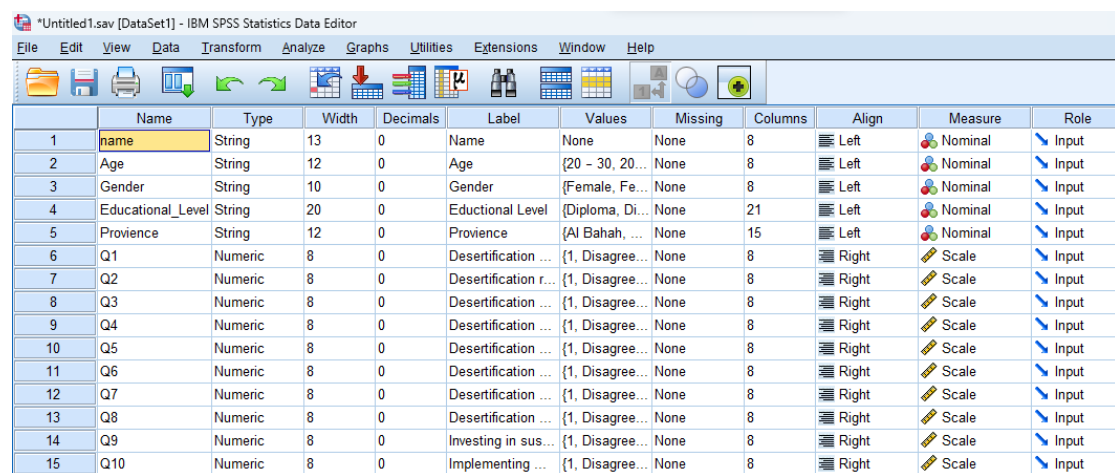
Introduction

The popular tool for statistical analysis that is SPSS to getting accurate results.

In this chapter will provide step by step for testing the quality of Survey and analysing the data of Survey result and all statistical tests to study the relationship between the desertification and KSA's economy and how does it impact on the economy.

- Exporting data from Google form as EXCEL format, then import it into SPSS,

The important step here is defining variables in Variable view page to choose the type of variable (String – numeric ..etc) , also insert the value labels as shown in below screenshots.



	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure	Role
1	name	String	13	0	Name	None	None	8	Left	Nominal	Input
2	Age	String	12	0	Age	{20 - 30, 20...	None	8	Left	Nominal	Input
3	Gender	String	10	0	Gender	{Female, Fe...	None	8	Left	Nominal	Input
4	Educational_Level	String	20	0	Educational Level	{Diploma, Di...	None	21	Left	Nominal	Input
5	Provience	String	12	0	Provience	{Al Bahah, ...	None	15	Left	Nominal	Input
6	Q1	Numeric	8	0	Desertification ...	{1, Disagree...	None	8	Right	Scale	Input
7	Q2	Numeric	8	0	Desertification r...	{1, Disagree...	None	8	Right	Scale	Input
8	Q3	Numeric	8	0	Desertification ...	{1, Disagree...	None	8	Right	Scale	Input
9	Q4	Numeric	8	0	Desertification ...	{1, Disagree...	None	8	Right	Scale	Input
10	Q5	Numeric	8	0	Desertification ...	{1, Disagree...	None	8	Right	Scale	Input
11	Q6	Numeric	8	0	Desertification ...	{1, Disagree...	None	8	Right	Scale	Input
12	Q7	Numeric	8	0	Desertification ...	{1, Disagree...	None	8	Right	Scale	Input
13	Q8	Numeric	8	0	Desertification ...	{1, Disagree...	None	8	Right	Scale	Input
14	Q9	Numeric	8	0	Investing in sus...	{1, Disagree...	None	8	Right	Scale	Input
15	Q10	Numeric	8	0	Implementing ...	{1, Disagree...	None	8	Right	Scale	Input

Figure1 Variable view Page

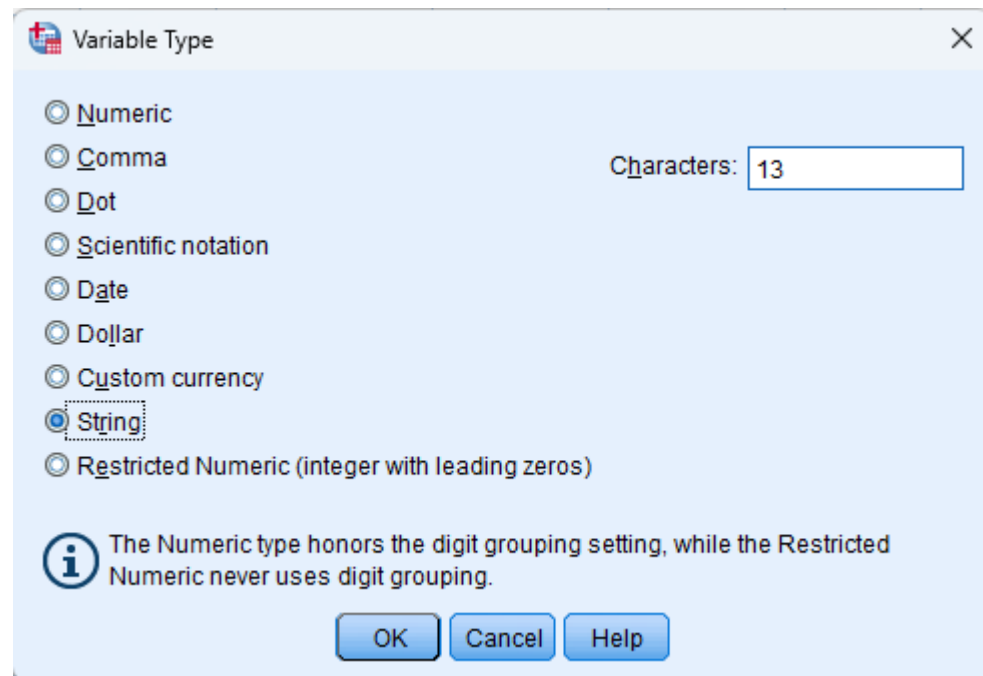


Figure2 Variable type list



Figure 3 Value Labels settings

- Then, the data will be displayed in data view page, here are two screenshots showing how to be the survey data.

	name	Age	Gender	Educational_Level	Province	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
1	Mohamad	31 - 40	Male	Undergraduate	Makkah	5	5	4	5	5	5	5	5
2	Fatima	31 - 40	FeMale	Undergraduate	Makkah	5	5	5	5	5	5	5	5
3	Norah	20 - 30	FeMale	Undergraduate	Makkah	5	4	3	5	4	4	5	5
4	Mohammed	41 - 50	Male	Undergraduate	Makkah	5	5	4	5	5	3	5	4
5	Ayman	41 - 50	Male	Undergraduate	Al Bahah	4	4	3	4	4	4	4	4
6	Khalid	41 - 50	Male	Undergraduate	Makkah	5	5	5	5	5	5	5	5
7	---	31 - 40	FeMale	High School	Makkah	4	4	4	4	4	4	4	4
8	Hassan	31 - 40	Male	Postgraduate	NB	4	4	4	4	4	4	4	4
9	Murad	31 - 40	Male	Undergraduate	Al Bahah	5	5	4	5	5	5	5	5
10	Ahmed	31 - 40	Male	Undergraduate	Hail	5	5	5	5	5	5	5	5
11	Abdullah	41 - 50	Male	Postgraduate	Al Qassim	4	4	4	4	4	4	4	4
12	Mahmoud	41 - 50	Male	Undergraduate	Riyadh	5	5	5	5	5	5	5	5
13	-	31 - 40	FeMale	Undergraduate	Hail	3	3	3	4	4	4	3	4
14	Ahmed	31 - 40	Male	Undergraduate	Gazan	5	5	5	5	5	5	5	5
15	Ayman	41 - 50	Male	Postgraduate	Al Madina	5	5	5	5	5	5	5	5
16	Omar	31 - 40	Male	Undergraduate	Al Qassim	5	5	5	5	5	5	5	5
17	Mohammed	41 - 50	Male	Postgraduate	Najran	4	4	4	4	4	4	4	4
18	Saeed	41 - 50	Male	Undergraduate	Riyadh	5	5	5	5	5	5	5	5
19	Ayman	41 - 50	Male	Undergraduate	Riyadh	4	5	2	5	2	4	3	3
20	Samar	31 - 40	FeMale	Postgraduate	Hail	5	5	5	5	5	5	5	5
21	Salah	41 - 50	Male	Postgraduate	Hail	4	4	4	4	4	4	1	4
22	Sara	31 - 40	FeMale	Diploma	Al Jouf	4	5	5	5	5	5	5	5
23	Rizan	31 - 40	FeMale	High School	Makkah	5	5	5	5	4	3	4	4

	name	Age	Gender	Educational_Level	Province	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
1	Mohamad	31-40	Male	Undergraduate	Makkah	Strongly a...	Strongly a...	Agree	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...
2	Fatima	31-40	FeMale	Undergraduate	Makkah	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...
3	Norah	20-30	FeMale	Undergraduate	Makkah	Strongly a...	Agree	Neither/Nor...	Strongly a...	Agree	Agree	Strongly a...	Strongly a...
4	Mohammed	41-50	Male	Undergraduate	Makkah	Strongly a...	Strongly a...	Agree	Strongly a...	Strongly a...	Neither/Nor...	Strongly a...	Agree
5	Ayman	41-50	Male	Undergraduate	Al Bahah	Agree	Agree	Neither/Nor...	Agree	Agree	Agree	Agree	Agree
6	Khalid	41-50	Male	Undergraduate	Makkah	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...
7	---	31-40	FeMale	High School	Makkah	Agree	Agree	Agree	Agree	Agree	Agree	Agree	Agree
8	Hassan	31-40	Male	Postgraduate	Northern Borders	Agree	Agree	Agree	Agree	Agree	Agree	Agree	Agree
9	Murad	31-40	Male	Undergraduate	Al Bahah	Strongly a...	Strongly a...	Agree	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...
10	Ahmed	31-40	Male	Undergraduate	Hail	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...
11	Abdullah	41-50	Male	Postgraduate	Al Qassim	Agree	Agree	Agree	Agree	Agree	Agree	Agree	Agree
12	Mahmoud	41-50	Male	Undergraduate	Riyadh	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...
13	-	31-40	FeMale	Undergraduate	Hail	Neither/Nor...	Neither/Nor...	Neither/Nor...	Agree	Agree	Agree	Neither/Nor...	Agree
14	Ahmed	31-40	Male	Undergraduate	Gazan	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...
15	Ayman	41-50	Male	Postgraduate	Al Madina	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...
16	Omar	31-40	Male	Undergraduate	Al Qassim	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...
17	Mohammed	41-50	Male	Postgraduate	Najran	Agree	Agree	Agree	Agree	Agree	Agree	Agree	Agree
18	Saeed	41-50	Male	Undergraduate	Riyadh	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...
19	Ayman	41-50	Male	Undergraduate	Riyadh	Agree	Strongly a...	Disagree	Strongly a...	Disagree	Agree	Neither/Nor...	Neither/Nor...
20	Samar	31-40	FeMale	Postgraduate	Hail	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...
21	Salah	41-50	Male	Postgraduate	Hail	Agree	Agree	Agree	Agree	Agree	Agree	Strongly di...	Agree
22	Sara	31-40	FeMale	Diploma	Al Jouf	Agree	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Strongly a...
23	Rizan	31-40	FeMale	High School	Makkah	Strongly a...	Strongly a...	Strongly a...	Strongly a...	Agree	Neither/Nor...	Agree	Agree

Figure 4 Data view page

Part1: Validity

- Start by perform the factor analysis that is a useful and popular method of multivariate research technique, mostly used in social and behavioral sciences. In addition, that technique represents a set of observed variables in terms of several 'common' factors. The common factors which are hypothetical variables which explain why some variables are correlated with each other. Here will use Exploratory Factor Analysis that is one of common method of multivariate research technique, and It will be applied in SPSS (EFA)

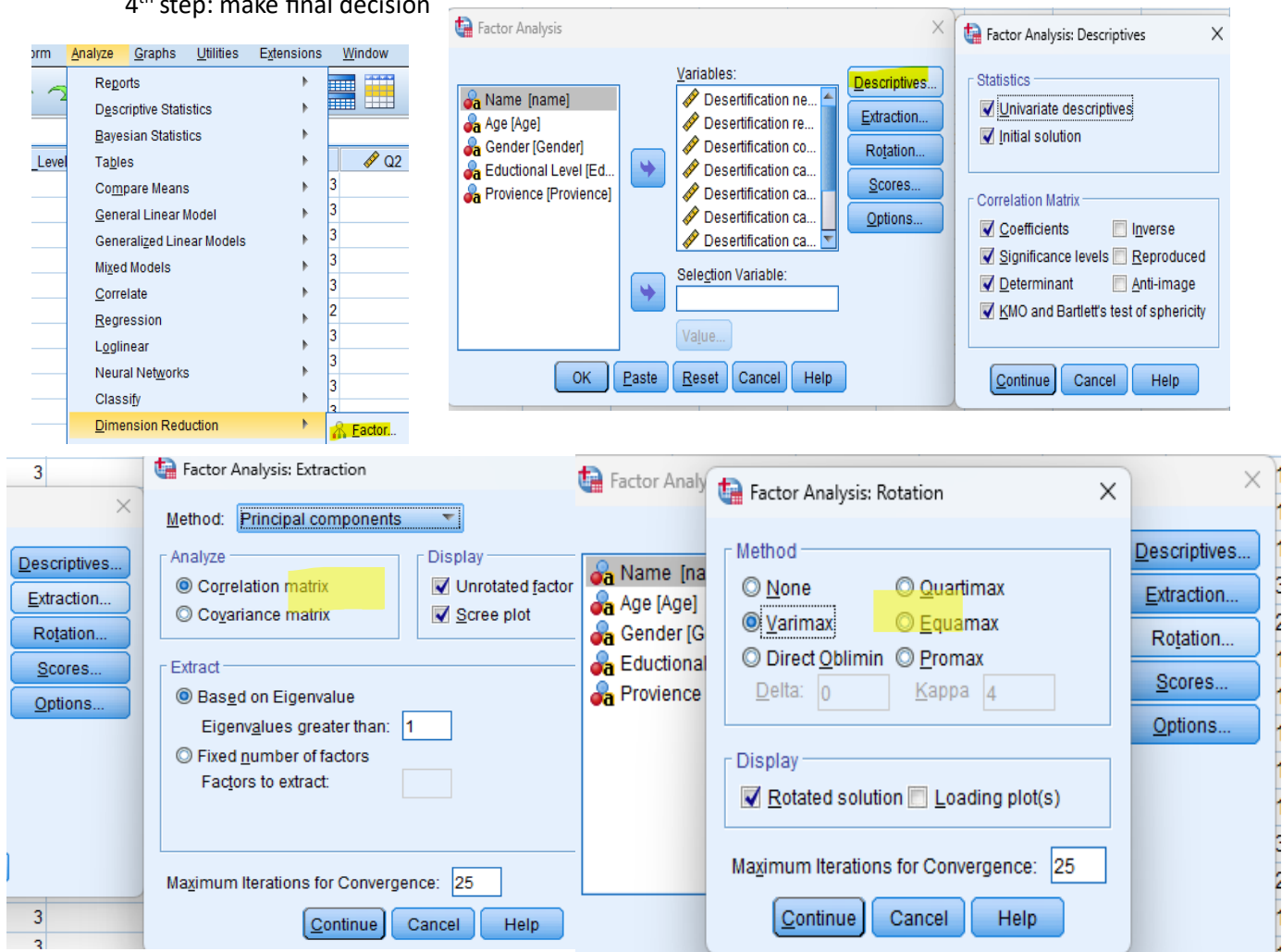
- The main four steps for EFA:

1ST step: the correlation matrix for all variables

2nd step: Factor Extraction

3rd step: Factor Rotation

4th step: make final decision



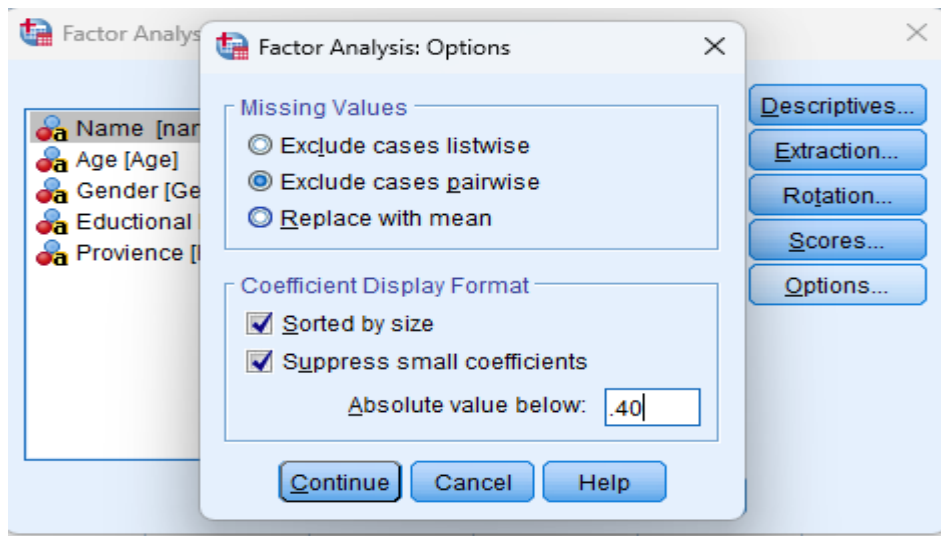


Figure 5 EFA Steps

Then will displayed the result in the outcome page, as shown in the screenshot.

- **Output1:** Correlation matrix, here is the screenshot from SPSS, after that we added the values of matrix in EXCEL to be clearer as seen in the below.

	Desertification negatively impacts agricultural productivity, leading to decreased food production and potential food insecurity	Desertification reduces the availability of water resources, affecting sectors such as industry, energy production, and tourism.	Desertification contributes to increased poverty rates as it reduces livelihood opportunities for communities dependent on agriculture and natural resources	Desertification can lead to increased conflicts over scarce resources, such as land and water, which can disrupt economic activities and hinder development.	Desertification can lead to increased rural-urban migration, exacerbating unemployment and poverty in urban areas.	Desertification can lead to the displacement of rural populations, putting pressure on urban areas and straining social services and infrastructure.	Desertification can hinder economic development and foreign investment, as it creates an unfavorable business environment and limits the potential for sustainable growth.	Desertification negatively impacts biodiversity and ecosystem services, which can have economic consequences such as decreased tourism revenue and loss of potential pharmaceutical resources.	Investing in sustainable land management practices can help mitigate desertification and provide economic benefits through increased agricultural productivity and job creation.	Implementing measures to combat desertification, such as reforestation and sustainable land management, can create green job opportunities and stimulate economic growth.
on	Desertification negatively impacts agricultural productivity, leading to decreased food production and potential food insecurity	Desertification reduces the availability of water resources, affecting sectors such as industry, energy production, and tourism.	Desertification contributes to increased poverty rates as it reduces livelihood opportunities for communities dependent on agriculture and natural resources	Desertification can lead to increased conflicts over scarce resources, such as land and water, which can disrupt economic activities and hinder development.	Desertification can lead to increased rural-urban migration, exacerbating unemployment and poverty in urban areas.	Desertification can lead to the displacement of rural populations, putting pressure on urban areas and straining social services and infrastructure.	Desertification can hinder economic development and foreign investment, as it creates an unfavorable business environment and limits the potential for sustainable growth.	Desertification negatively impacts biodiversity and ecosystem services, which can have economic consequences such as decreased tourism revenue and loss of potential pharmaceutical resources.	Investing in sustainable land management practices can help mitigate desertification and provide economic benefits through increased agricultural productivity and job creation.	Implementing measures to combat desertification, such as reforestation and sustainable land management, can create green job opportunities and stimulate economic growth.
	1.000	.146	.260	.146	.187	.265	.156	.116	.165	.15
	.146	1.000	.608	.548	.445	.479	.480	.388	.278	.51
	.260	.608	1.000	.579	.488	.648	.467	.374	.374	.47

Figure 6 Correlation Matrix

Correlation Matrix ^a										
	Impacts agricultural productivity, leading to, affecting food opportunities as land degradation, exacting pressure, creates an economic consequence and provokes desertification									
Correlation	Desertification negatively impacts agricultural productivity, leading to, affecting food opportunities as land degradation, exacting pressure, creates an economic consequence and provokes desertification	1.000	0.146	0.260	0.146	0.187	0.265	0.156	0.116	0.165
	Desertification reduces the availability of land for agriculture	0.146	1.000	0.608	0.548	0.445	0.479	0.480	0.388	0.278
	Desertification contributes to land degradation	0.260	0.608	1.000	0.579	0.488	0.648	0.467	0.374	0.374
	Desertification can lead to increased land degradation	0.146	0.548	0.579	1.000	0.497	0.477	0.421	0.340	0.235
	Desertification can lead to increased land degradation	0.187	0.445	0.488	0.497	1.000	0.500	0.300	0.353	0.165
	Desertification can lead to the degradation of land	0.265	0.479	0.648	0.477	0.500	1.000	0.466	0.456	0.353
	Desertification can hinder economic development	0.156	0.480	0.467	0.421	0.300	0.466	1.000	0.604	0.478
	Desertification negatively impacts agricultural productivity, leading to, affecting food opportunities as land degradation, exacting pressure, creates an economic consequence and provokes desertification	0.116	0.388	0.374	0.340	0.353	0.456	0.604	1.000	0.462
	Investing in sustainable land management practices	0.165	0.278	0.374	0.235	0.165	0.353	0.478	0.462	1.000
Sig. (1-tailed)	Implementing measures to combat desertification	0.153	0.510	0.470	0.397	0.342	0.471	0.619	0.512	0.507
	Desertification negatively impacts agricultural productivity, leading to, affecting food opportunities as land degradation, exacting pressure, creates an economic consequence and provokes desertification	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000
	Desertification reduces the availability of land for agriculture	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Desertification contributes to land degradation	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Desertification can lead to increased land degradation	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Desertification can lead to increased land degradation	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Desertification can lead to the degradation of land	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Desertification can hinder economic development	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Desertification negatively impacts agricultural productivity, leading to, affecting food opportunities as land degradation, exacting pressure, creates an economic consequence and provokes desertification	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Investing in sustainable land management practices	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Implementing measures to combat desertification	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 4 Correlation Matrix

- **Output2:** Kaiser Meyer Olkin and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.890
Bartlett's Test of Sphericity	Approx. Chi-Square	2108.127
	df	45
	Sig.	.000

Table 5 Kaiser Meyer Olkin and Bartlett's Test outcome

- **Output3:** lists the eigenvalues associated with each linear component (factor) before extraction, after extraction and after rotation.

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.685	46.850	46.850	4.685	46.850	46.850	3.059	30.587	30.587
2	1.186	11.856	58.706	1.186	11.856	58.706	2.812	28.119	58.706
3	.955	9.547	68.253						
4	.629	6.294	74.547						
5	.563	5.630	80.177						
6	.486	4.862	85.039						
7	.469	4.692	89.731						
8	.407	4.068	93.799						
9	.335	3.346	97.144						
10	.286	2.856	100.000						

Extraction Method: Principal Component Analysis.

Table 6 Lists the eigenvalues associated with each linear component (factor) before extraction, after extraction and after rotation

- **Output4:** Communalities and Component matrix. here is the screenshot from SPSS, after that we added the values in a table to be clearer as seen in the below.

Communalities		
	Initial	Extraction
Desertification negatively impacts agricultural productivity, leading to decreased food production and potential food insecurity	1.000	.147
Desertification reduces the availability of water resources, affecting sectors such as industry, energy production, and tourism.	1.000	.587
Desertification contributes to increased poverty rates as it reduces livelihood opportunities for communities dependent on agriculture and natural resources	1.000	.699
Desertification can lead to increased conflicts over scarce resources, such as land and water, which can disrupt economic activities and hinder development.	1.000	.612
Desertification can lead to increased rural-urban migration, exacerbating unemployment and poverty in urban areas.	1.000	.595
Desertification can lead to the displacement of rural populations, putting pressure on urban areas and straining social services and infrastructure.	1.000	.618

Component Matrix ^a		
	Component	
	1	2
Desertification negatively impacts agricultural productivity, leading to decreased food production and potential food insecurity		
Desertification reduces the availability of water resources, affecting sectors such as industry, energy production, and tourism.	.740	
Desertification contributes to increased poverty rates as it reduces livelihood opportunities for communities dependent on agriculture and natural resources	.792	
Desertification can lead to increased conflicts over scarce resources, such as land and water, which can disrupt economic activities and hinder development.	.698	
Desertification can lead to increased rural-urban migration, exacerbating unemployment and poverty in urban areas.	.631	.444

Figure 7Communalities and Component matrix

Communalities		
	Initial	Extraction
Desertification negatively impacts agricultural productivity, leading to decreased food production and potential food insecurity	1.000	0.147
Desertification reduces the availability of water resources, affecting sectors such as industry, energy production, and tourism.	1.000	0.587
Desertification contributes to increased poverty rates as it reduces livelihood opportunities for communities dependent on agriculture and natural resources	1.000	0.699
Desertification can lead to increased conflicts over scarce resources, such as land and water, which can disrupt economic activities and hinder development.	1.000	0.612
Desertification can lead to increased rural-urban migration, exacerbating unemployment and poverty in urban areas.	1.000	0.595
Desertification can lead to the displacement of rural populations, putting pressure on urban areas and straining social services and infrastructure.	1.000	0.618
Desertification can hinder economic development and foreign investment, as it creates an unfavorable business environment and limits the potential for sustainable growth.	1.000	0.697
Desertification negatively impacts biodiversity and ecosystem services, which can have economic consequences such as decreased tourism revenue and loss of potential pharmaceutical resources.	1.000	0.620
Investing in sustainable land management practices can help mitigate desertification and provide economic benefits through increased agricultural productivity and job creation.	1.000	0.634
Implementing measures to combat desertification, such as reforestation and sustainable land management, can create green job opportunities and stimulate economic growth.	1.000	0.663

Table 7Communalities

Component Matrix ^a		
	Component	
	1	2
Desertification negatively impacts agricultural productivity, leading to decreased food production and potential food insecurity		
Desertification reduces the availability of water resources, affecting sectors such as industry, energy production, and tourism.	0.740	
Desertification contributes to increased poverty rates as it reduces livelihood opportunities for communities dependent on agriculture and natural resources	0.792	
Desertification can lead to increased conflicts over scarce resources, such as land and water, which can disrupt economic activities and hinder development.	0.698	
Desertification can lead to increased rural-urban migration, exacerbating unemployment and poverty in urban areas.	0.631	0.444
Desertification can lead to the displacement of rural populations, putting pressure on urban areas and straining social services and infrastructure.	0.766	
Desertification can hinder economic development and foreign investment, as it creates an unfavorable business environment and limits the potential for sustainable growth.	0.752	
Desertification negatively impacts biodiversity and ecosystem services, which can have economic consequences such as decreased tourism revenue and loss of potential pharmaceutical resources.	0.688	
Investing in sustainable land management practices can help mitigate desertification and provide economic benefits through increased agricultural productivity and job creation.	0.583	- 0.541
Implementing measures to combat desertification, such as reforestation and sustainable land management, can create green job opportunities and stimulate economic growth.	0.750	

Table 8 Component Matrix

▪ **Output5: Scree Plot**

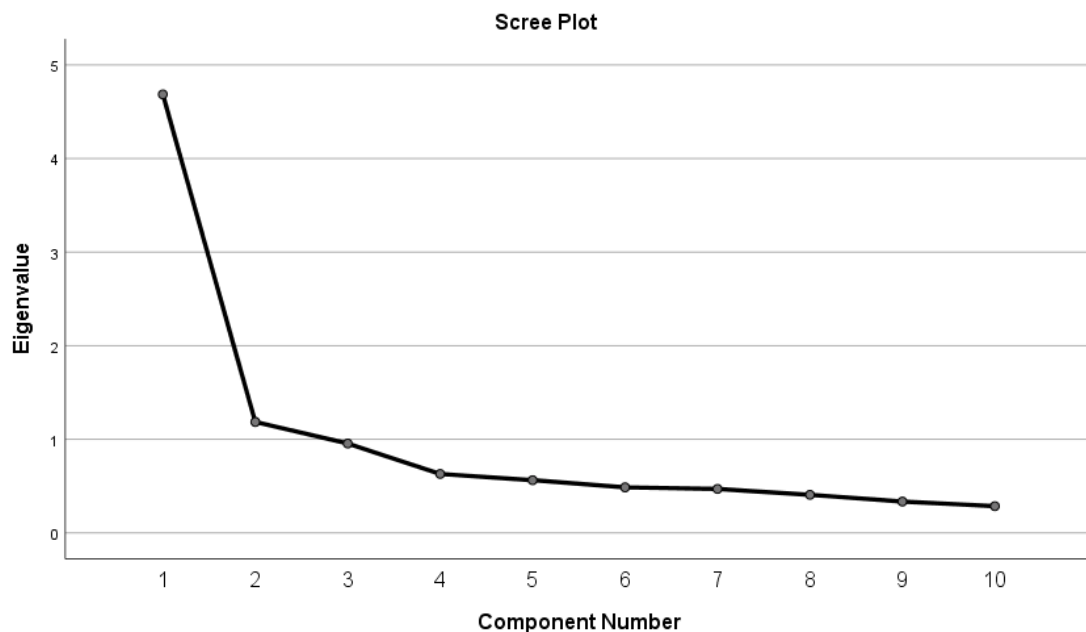


Figure 8 Scree Plot

- **Output6:** Rotated component matrix, here is the screenshot from SPSS, after that we added the values of Rotated Component Matrix in EXCEL to be clearer as seen in the below.

Rotated Component Matrix ^a		
	Component	
	1	2
Desertification negatively impacts agricultural productivity, leading to decreased food production and potential food insecurity		
Desertification reduces the availability of water resources, affecting sectors such as industry, energy production, and tourism.	.676	
Desertification contributes to increased poverty rates as it reduces livelihood opportunities for communities dependent on agriculture and natural resources	.762	
Desertification can lead to increased conflicts over scarce resources, such as land and water, which can disrupt economic activities and hinder development.	.751	
Desertification can lead to increased rural-urban migration, exacerbating unemployment and poverty in urban areas.	.764	

Figure 9 Rotated component matrix

Rotated Component Matrix ^a		
	Component	
	1	2
Desertification negatively impacts agricultural productivity, leading to decreased food production and potential food insecurity		
Desertification reduces the availability of water resources, affecting sectors such as industry, energy production, and tourism.	0.676	
Desertification contributes to increased poverty rates as it reduces livelihood opportunities for communities dependent on agriculture and natural resources	0.762	
Desertification can lead to increased conflicts over scarce resources, such as land and water, which can disrupt economic activities and hinder development.	0.751	
Desertification can lead to increased rural-urban migration, exacerbating unemployment and poverty in urban areas.	0.764	
Desertification can lead to the displacement of rural populations, putting pressure on urban areas and straining social services and infrastructure.	0.682	
Desertification can hinder economic development and foreign investment, as it creates an unfavorable business environment and limits the potential for sustainable growth.		0.778
Desertification negatively impacts biodiversity and ecosystem services, which can have economic consequences such as decreased tourism revenue and loss of potential pharmaceutical resources.		0.749
Investing in sustainable land management practices can help mitigate desertification and provide economic benefits through increased agricultural productivity and job creation.		0.794
Implementing measures to combat desertification, such as reforestation and sustainable land management, can create green job opportunities and stimulate economic growth.		0.743

Table 9 Rotated component matrix

Part2: Reliability

Using Cronbach's alpha that is the most common measure of internal consistency for reliability.

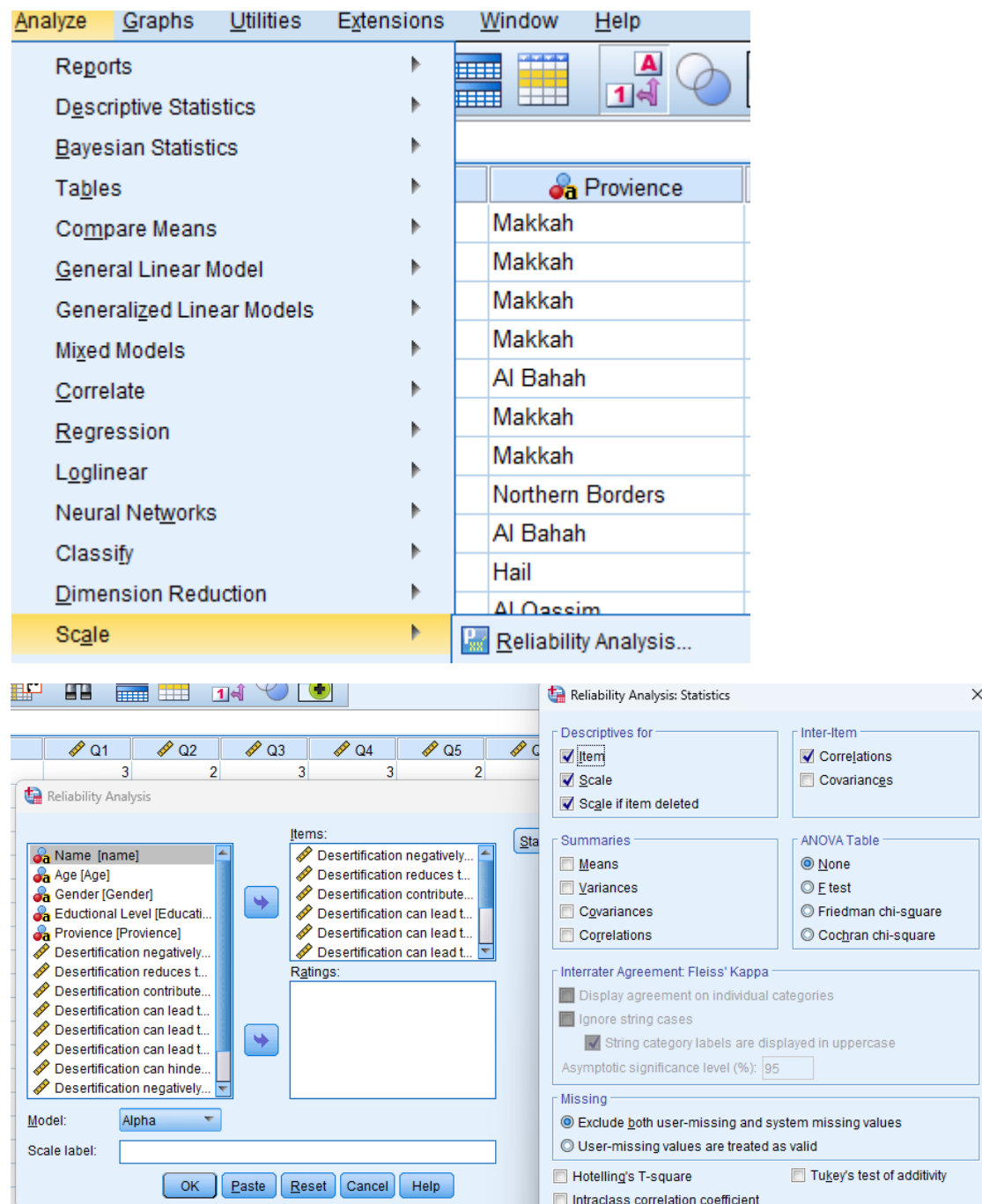


Figure 10 Reliability Analysis steps

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.865	.866	10

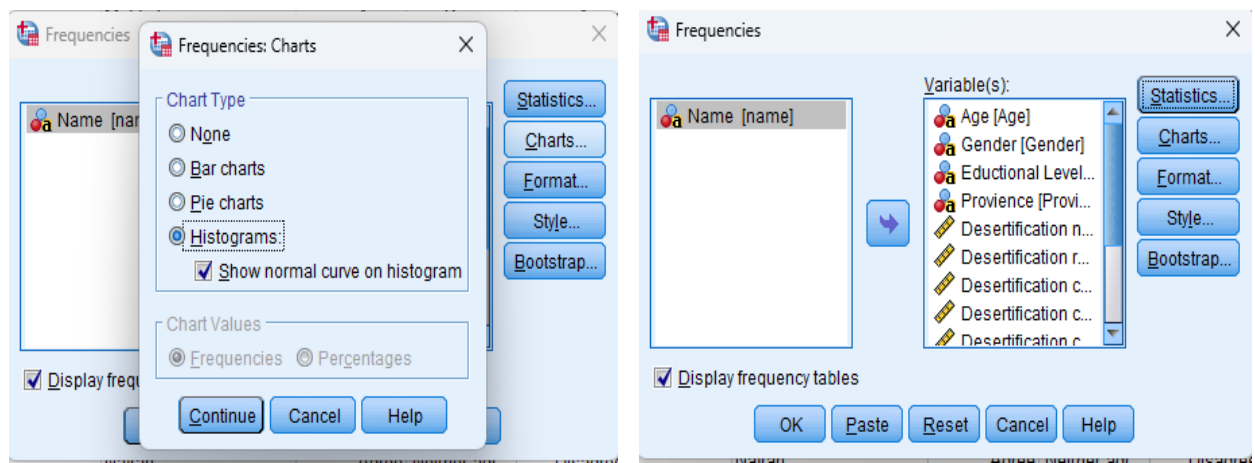
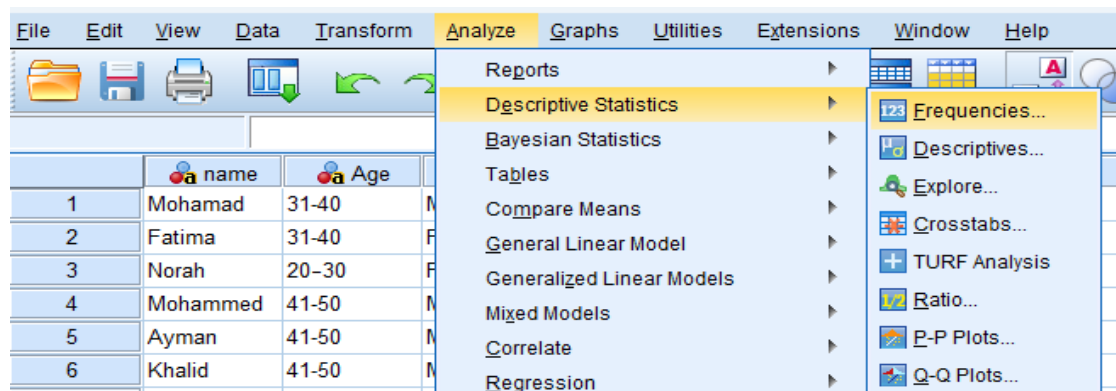
Figure 11 Reliability statistics Result

PART3: Descriptive Statistics

- After that, we will start to describe the sample by using descriptive statistics that is helpful analysis tool to represent percentages and frequencies of the sample who participated in the current study and responded to the questionnaire.

Here are the steps to perform the descriptive statistics:

1st step: choose descriptive statistics then Frequencies from analyze.



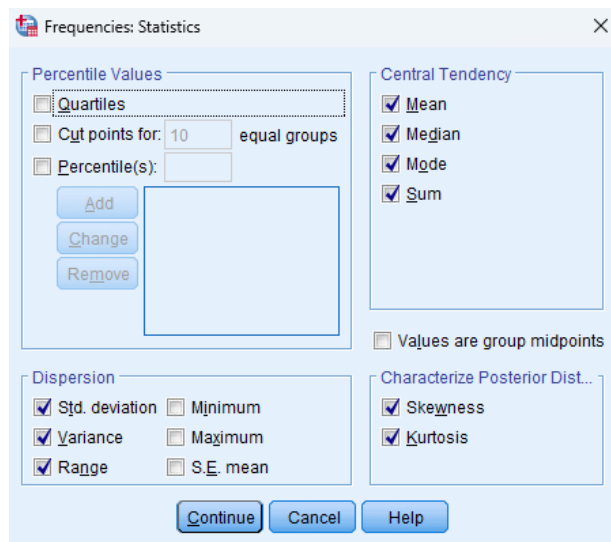


Figure 12 Descriptive statistics steps

- Then, getting the output in new page for the outcome that includes (Tables – charts), as provided in the below screenshots.

Section1: Demographic characteristics of the research sample respondents

Age					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20-30	257	49.4	49.4	49.4
	31-40	123	23.7	23.7	73.1
	41-50	116	22.3	22.3	95.4
	51 & Above	24	4.6	4.6	100.0
	Total	520	100.0	100.0	

Table 10 Frequencies Table by Age

Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	188	36.2	36.2	36.2
	Male	332	63.8	63.8	100.0
	Total	520	100.0	100.0	

Table 11 Frequencies Table by Gender

Educational Level		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Diploma	38	7.3	7.3	7.3
	High School	29	5.6	5.6	12.9
	Postgraduate	95	18.3	18.3	31.2
	Undergraduate	358	68.8	68.8	100.0
	Total	520	100.0	100.0	

Table 12 Frequencies Table by Educational Level

Province		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Al Bahah	21	4.0	4.0	4.0
	Al Jouf	32	6.2	6.2	10.2
	Al Madina	28	5.4	5.4	15.6
	Al Qassim	27	5.2	5.2	20.8
	Asir	17	3.3	3.3	24.0
	Eastern	71	13.7	13.7	37.7
	Gazan	32	6.2	6.2	43.8
	Hail	49	9.4	9.4	53.3
	Makkah	70	13.5	13.5	66.7
	Najran	27	5.2	5.2	71.9
	Northern Borders	26	5.0	5.0	76.9
	Riyadh	94	18.1	18.1	95.0
	Tabuk	26	5.0	5.0	100.0
	Total	520	100.0	100.0	

Table 13 Frequencies Table by Province

Section2: Responses of Research questions by research sample respondents

- Before insert the table of descriptive statistics for each question, there is a code for each question due to the long for each question.

Question	Code
Desertification negatively impacts agricultural productivity, leading to decreased food production and potential food insecurity	Q1
Desertification reduces the availability of water resources, affecting sectors such as industry, energy production, and tourism.	Q2
Desertification contributes to increased poverty rates as it reduces livelihood opportunities for communities dependent on agriculture and natural resources	Q3
Desertification can lead to increased conflicts over scarce resources, such as land and water, which can disrupt economic activities and hinder development.	Q4
Desertification can lead to increased rural-urban migration, exacerbating unemployment and poverty in urban areas.	Q5
Desertification can lead to the displacement of rural populations, putting pressure on urban areas and straining social services and infrastructure.	Q6
Desertification can hinder economic development and foreign investment, as it creates an unfavorable business environment and limits the potential for sustainable growth.	Q7
Desertification negatively impacts biodiversity and ecosystem services, which can have economic consequences such as decreased tourism revenue and loss of potential pharmaceutical resources.	Q8

Investing in sustainable land management practices can help mitigate desertification and provide economic benefits through increased agricultural productivity and job creation.	Q9
Implementing measures to combat desertification, such as reforestation and sustainable land management, can create green job opportunities and stimulate economic growth.	Q10

Table 14 Coding for the questions

Question1: Desertification negatively impacts agricultural productivity, leading to decreased food production and potential food insecurity:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	5	1.0	1.0	1.0
	Disagree	11	2.1	2.1	3.1
	Neither/Nor agree	32	6.2	6.2	9.2
	Agree	149	28.7	28.7	37.9
	Strongly agree	323	62.1	62.1	100.0
	Total	520	100.0	100.0	

Table 15 Responses of question1

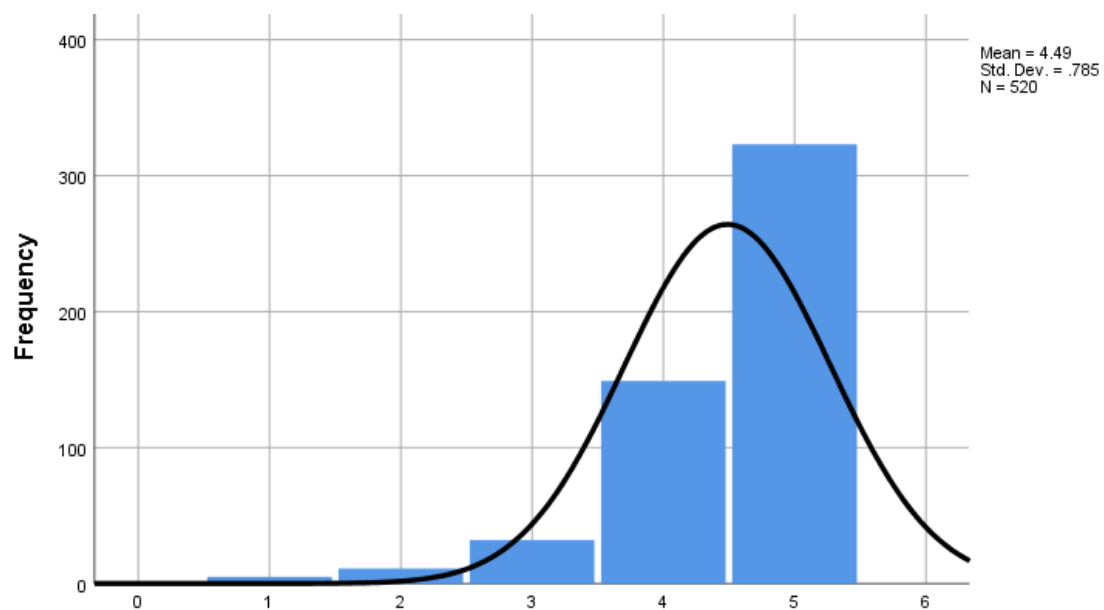


Figure 13 Histogram chart of Responses of question1

Q2: Desertification reduces the availability of water resources, affecting sectors such as industry, energy production, and tourism.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	1	.2	.2	.2
	Disagree	3	.6	.6	.8
	Neither/Nor agree	30	5.8	5.8	6.5
	Agree	149	28.7	28.7	35.2
	Strongly agree	337	64.8	64.8	100.0
	Total	520	100.0	100.0	

Table 16 Responses of question2

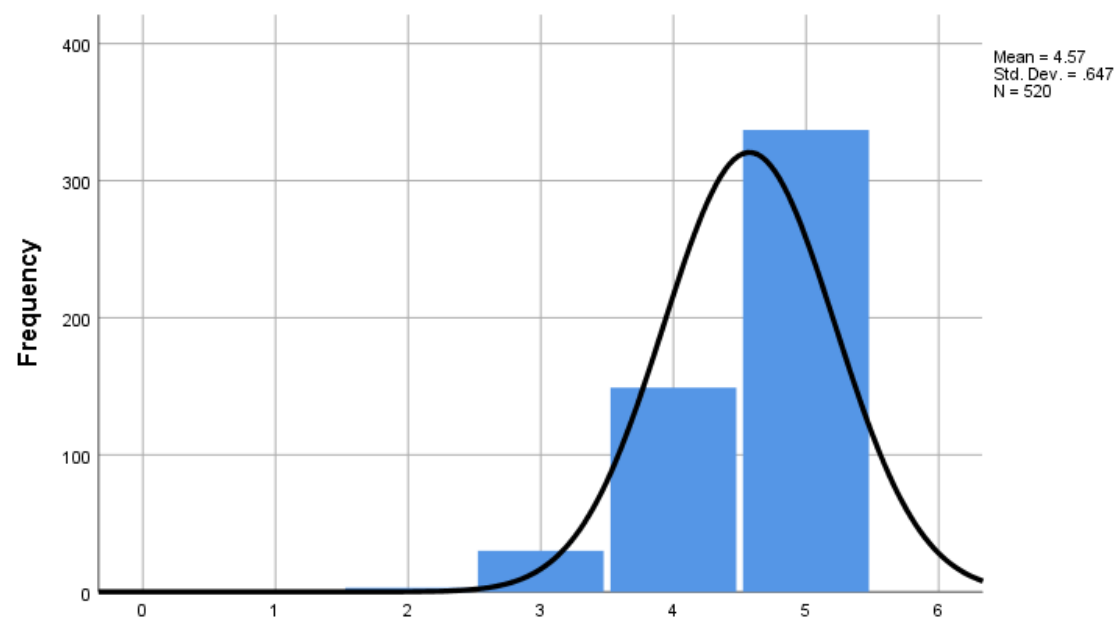


Figure 14 Histogram chart of Responses of question2

Q3: Desertification contributes to increased poverty rates as it reduces livelihood opportunities for communities dependent on agriculture and natural resources.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	5	1.0	1.0	1.0
	Disagree	12	2.3	2.3	3.3
	Neither/Nor agree	52	10.0	10.0	13.3
	Agree	146	28.1	28.1	41.3
	Strongly agree	305	58.7	58.7	100.0
	Total	520	100.0	100.0	

Table 17 Responses of question3

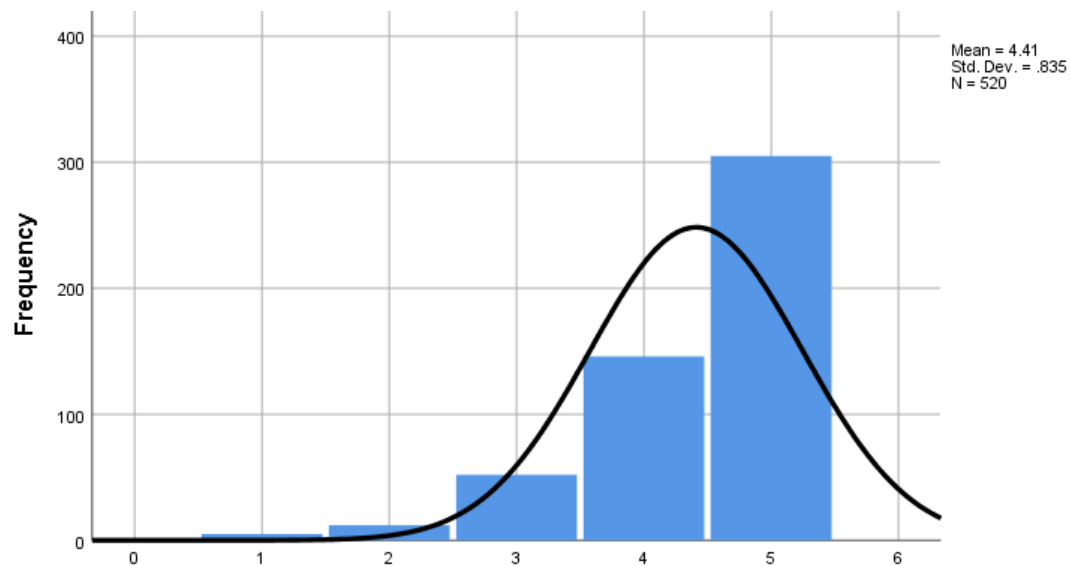


Figure 15 Histogram chart of Responses of question3

Q4: Desertification can lead to increased conflicts over scarce resources, such as land and water, which can disrupt economic activities and hinder development.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	3	.6	.6	.6
	Disagree	15	2.9	2.9	3.5
	Neither/Nor agree	25	4.8	4.8	8.3
	Agree	132	25.4	25.4	33.7
	Strongly agree	345	66.3	66.3	100.0
Total		520	100.0	100.0	

Table 18 Responses of question4

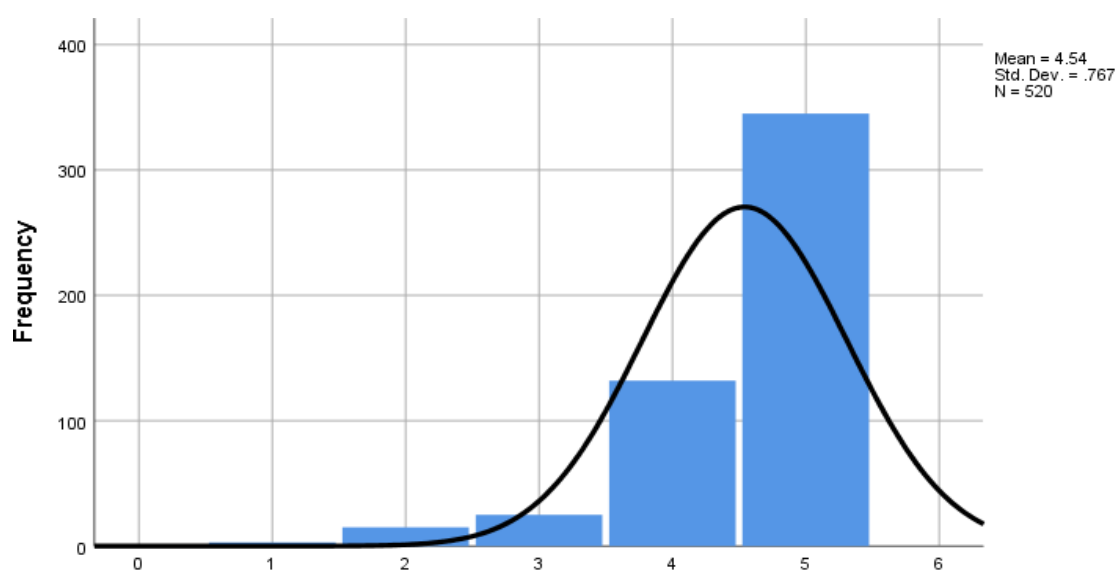


Figure 16 Histogram chart of Responses of question4

Q5: Desertification can lead to increased rural-urban migration, exacerbating unemployment and poverty in urban areas.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	6	1.2	1.2	1.2
	Disagree	10	1.9	1.9	3.1
	Neither/Nor agree	45	8.7	8.7	11.7
	Agree	140	26.9	26.9	38.7
	Strongly agree	319	61.3	61.3	100.0
	Total	520	100.0	100.0	

Table 19 Responses of question5

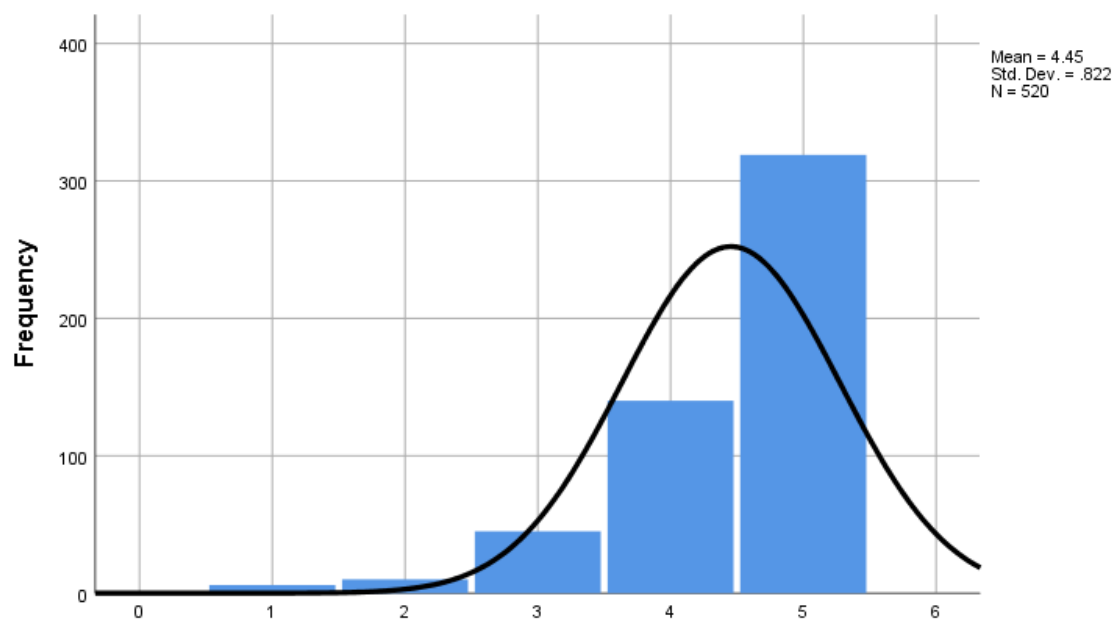


Figure 17 Histogram chart of Responses of question5

Q6: Desertification can lead to the displacement of rural populations, putting pressure on urban areas and straining social services and infrastructure.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	7	1.3	1.3	1.3
	Disagree	4	.8	.8	2.1
	Neither/Nor agree	34	6.5	6.5	8.7
	Agree	158	30.4	30.4	39.0
	Strongly agree	317	61.0	61.0	100.0
	Total	520	100.0	100.0	

Table 20 Responses of question6

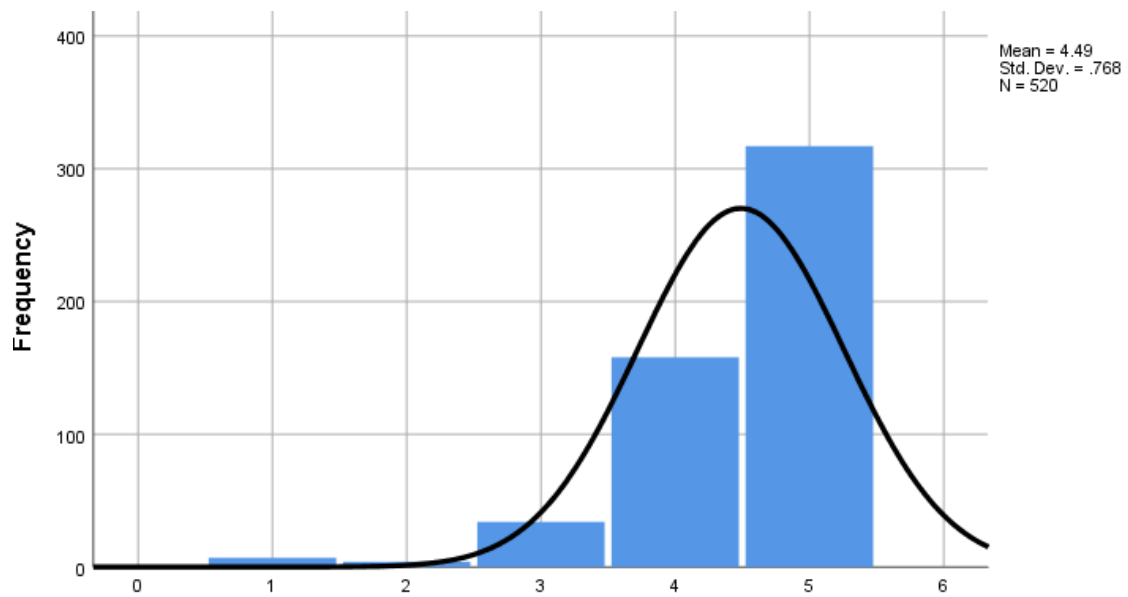


Figure 18 Histogram chart of Responses of question6

Q7: Desertification can hinder economic development and foreign investment, as it creates an unfavorable business environment and limits the potential for sustainable growth.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	3	.6	.6	.6
	Disagree	12	2.3	2.3	2.9
	Neither/Nor agree	46	8.8	8.8	11.7
	Agree	140	26.9	26.9	38.7
	Strongly agree	319	61.3	61.3	100.0
	Total	520	100.0	100.0	

Table 21 Responses of question7

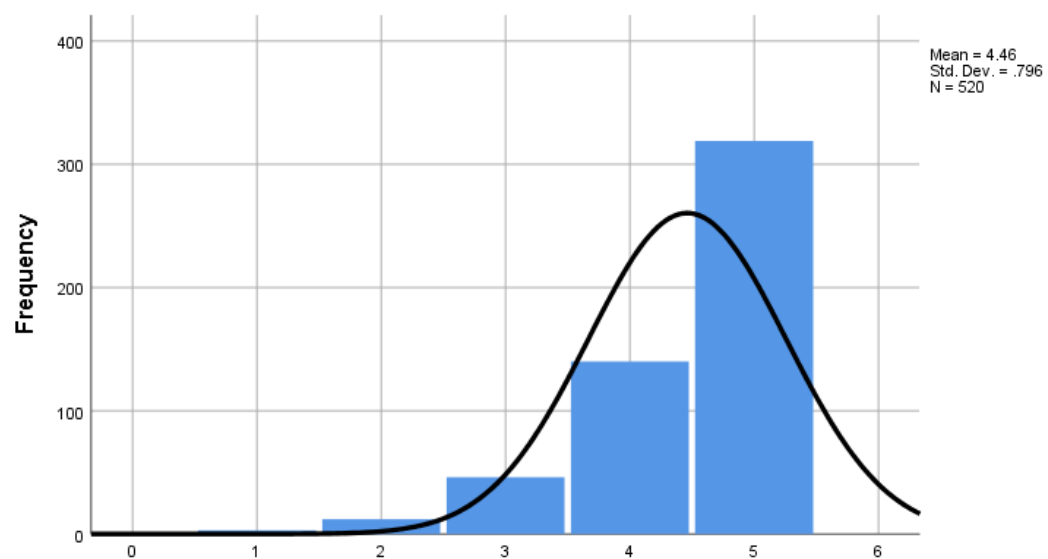


Figure 19 Histogram chart of Responses of question7

Q8: Desertification negatively impacts biodiversity and ecosystem services, which can have economic consequences such as decreased tourism revenue and loss of potential pharmaceutical resources.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	3	.6	.6	.6
	Disagree	13	2.5	2.5	3.1
	Neither/Nor agree	27	5.2	5.2	8.3
	Agree	142	27.3	27.3	35.6
	Strongly agree	335	64.4	64.4	100.0
	Total	520	100.0	100.0	

Table 22 Responses of question8

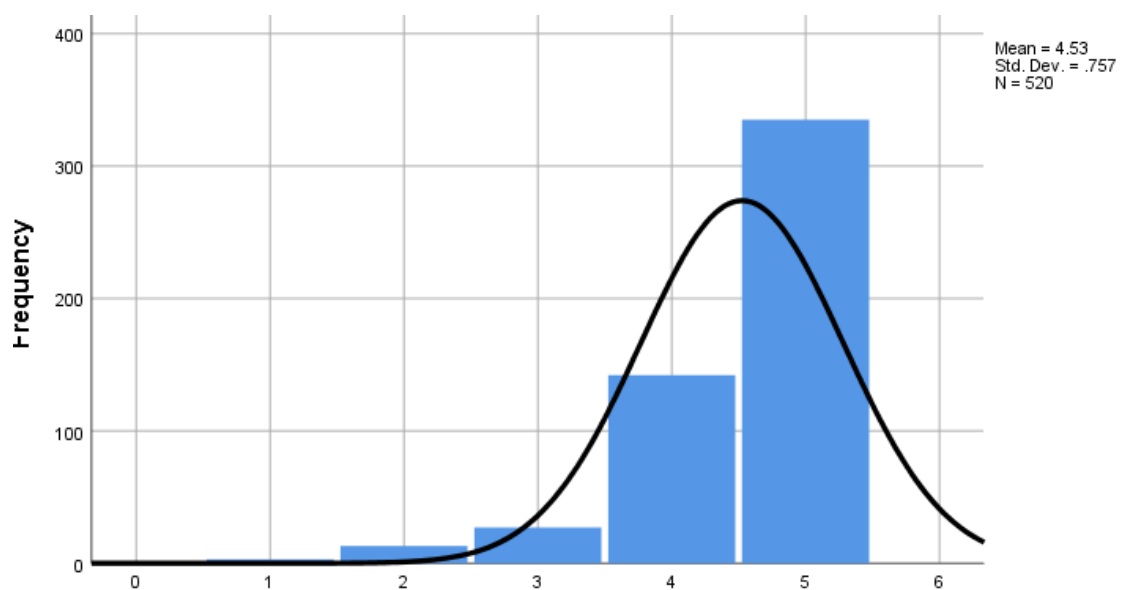


Figure 20 Histogram chart of Responses of question8

Q9: Investing in sustainable land management practices can help mitigate desertification and provide economic benefits through increased agricultural productivity and job creation.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	6	1.2	1.2	1.2
	Disagree	9	1.7	1.7	2.9
	Neither/Nor agree	39	7.5	7.5	10.4
	Agree	141	27.1	27.1	37.5
	Strongly agree	325	62.5	62.5	100.0
	Total	520	100.0	100.0	

Table 23 Responses of question9

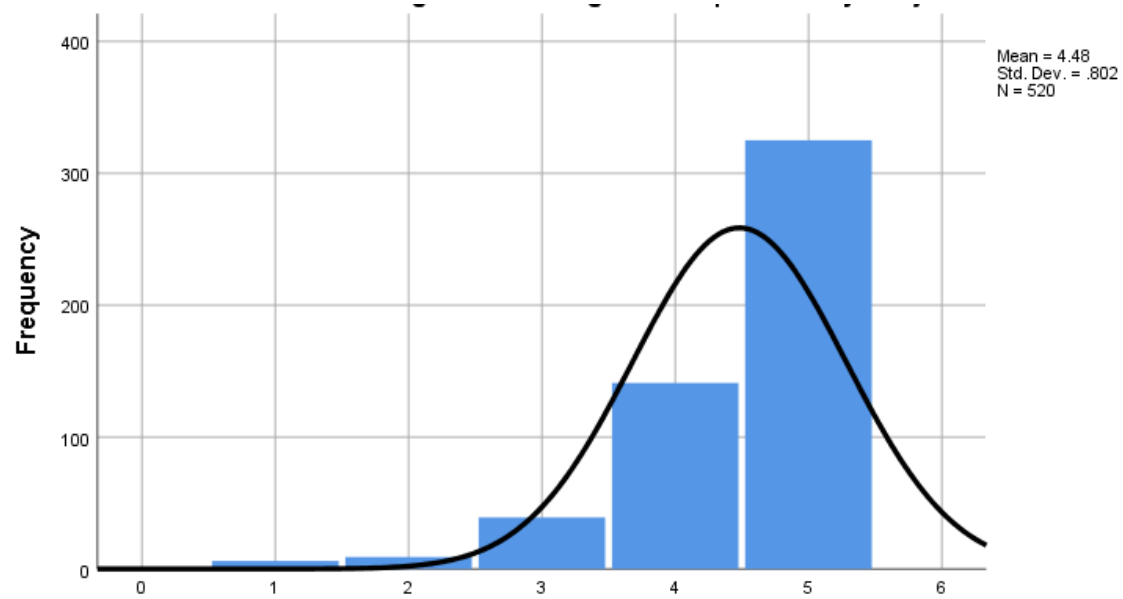


Figure 21 Histogram chart of Responses of question9

Q10: Implementing measures to combat desertification, such as reforestation and sustainable land management, can create green job opportunities and stimulate economic growth.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	6	1.2	1.2	1.2
	Disagree	9	1.7	1.7	2.9
	Neither/Nor agree	24	4.6	4.6	7.5
	Agree	156	30.0	30.0	37.5
	Strongly agree	325	62.5	62.5	100.0
Total		520	100.0	100.0	

Table 24 Responses of question10

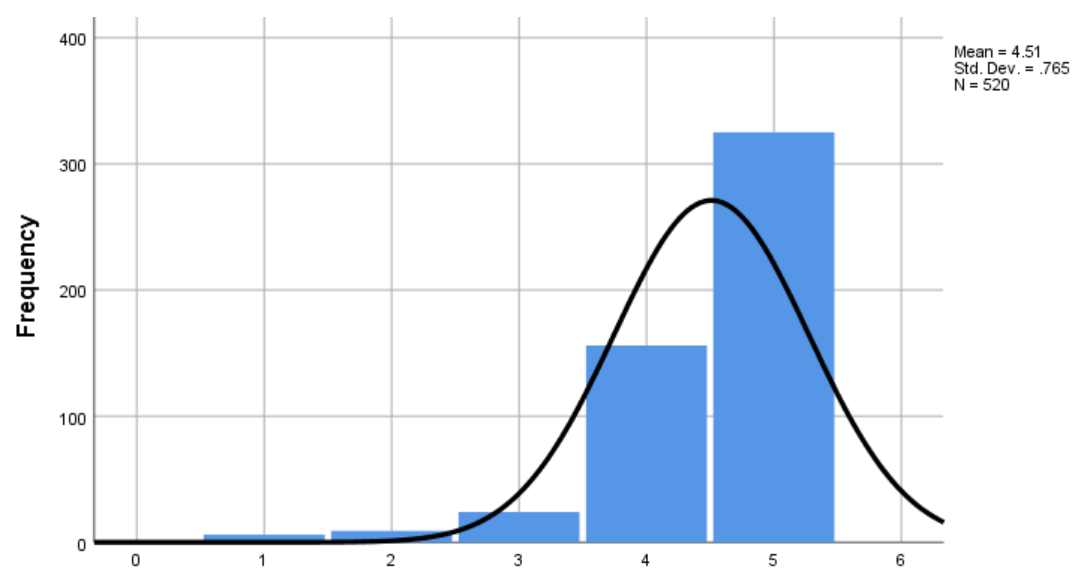


Figure 22 Histogram chart of Responses of question10

- Also, there is another way to find descriptive statistics, the steps are shown in the below:

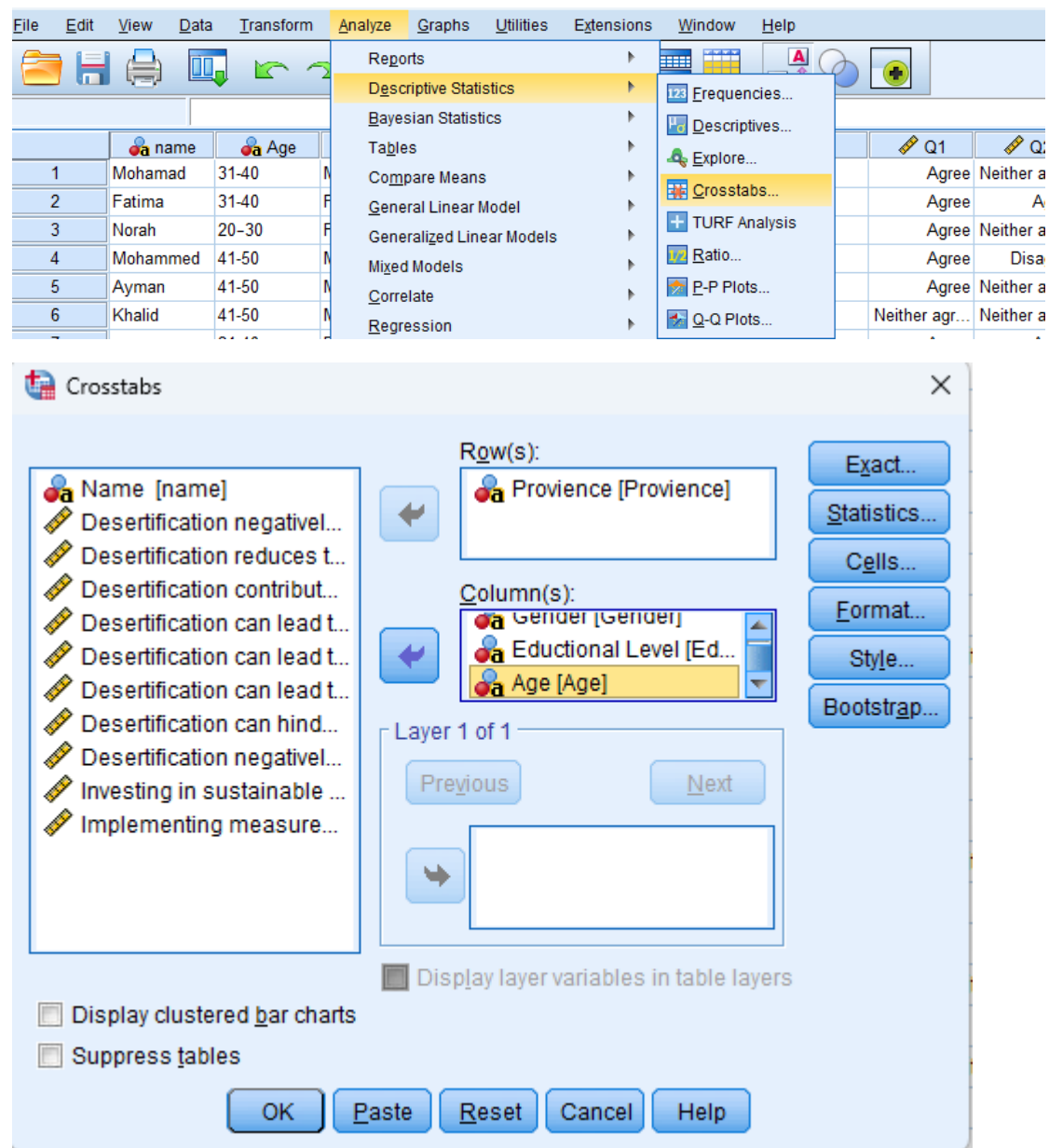


Figure 23 Crosstabs steps

- Then, it will display the outcome (Tables and charts) in the outcome page, It will be the same result of the previous method. Also in the below figures are only example to the result because if we display all outcome, that will be repeating for the previous way.

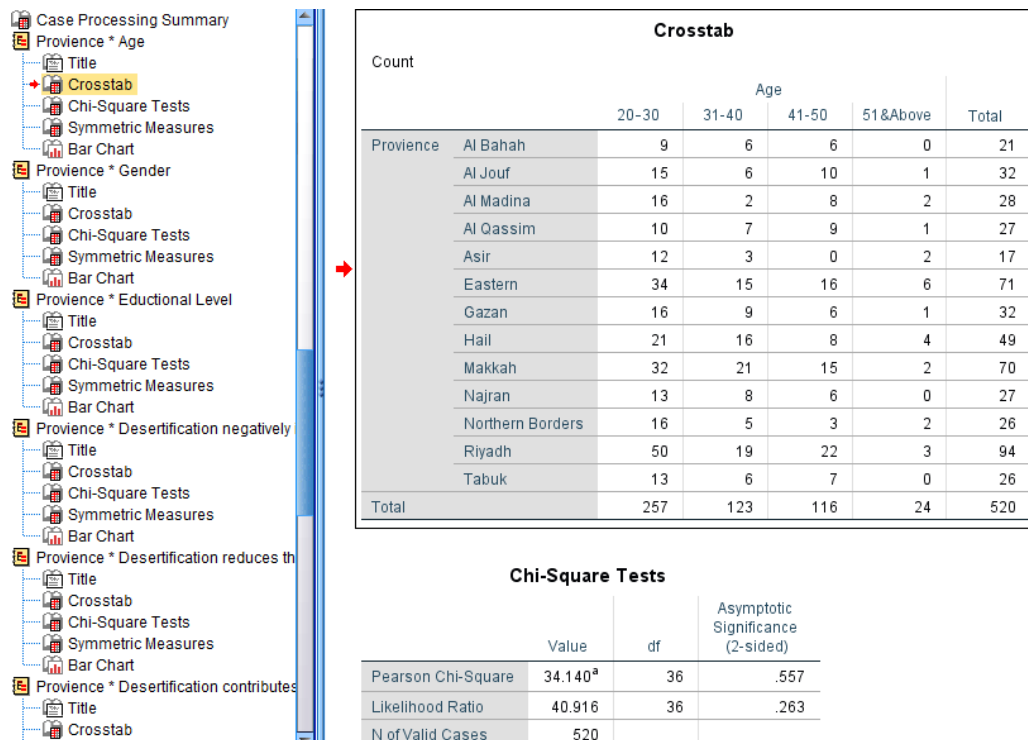


Figure 24 Crosstab outcome

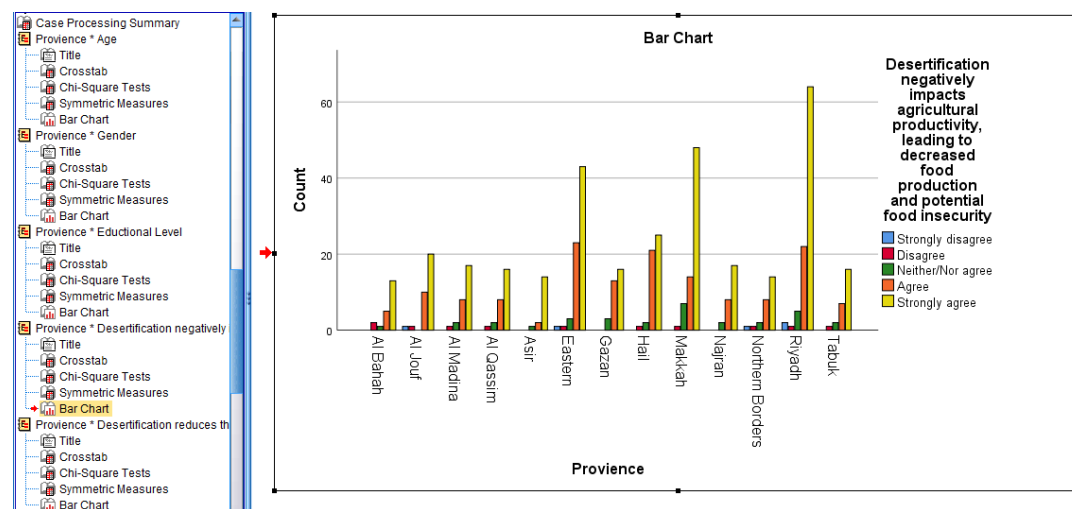


Figure 25 Figure: Bar chart for Crosstab outcome

- After that, we should apply the normality test to check the status of the data.

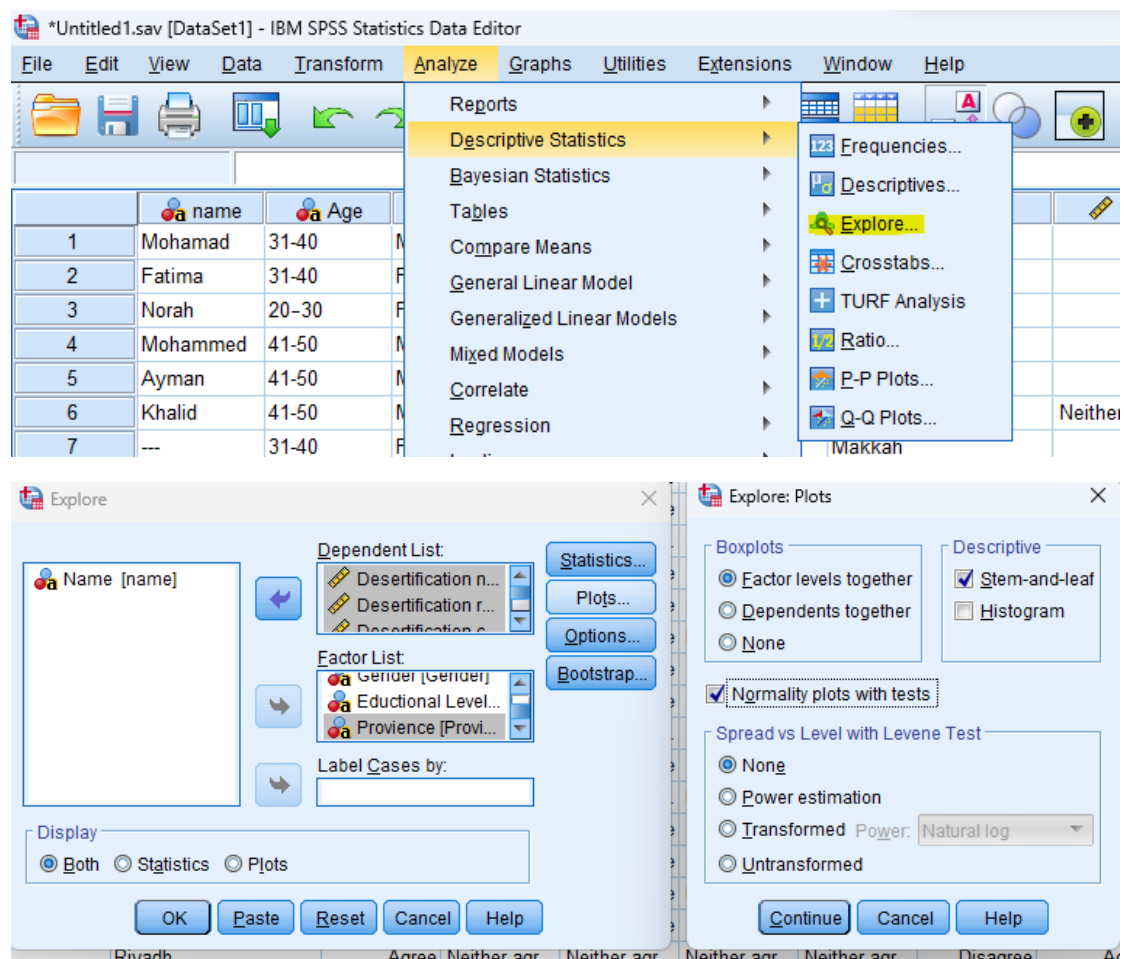


Figure 26 Normality Test steps

- Then, the result will be provided in the outcome page as seen in the below figures and tables that called Normality test summary.

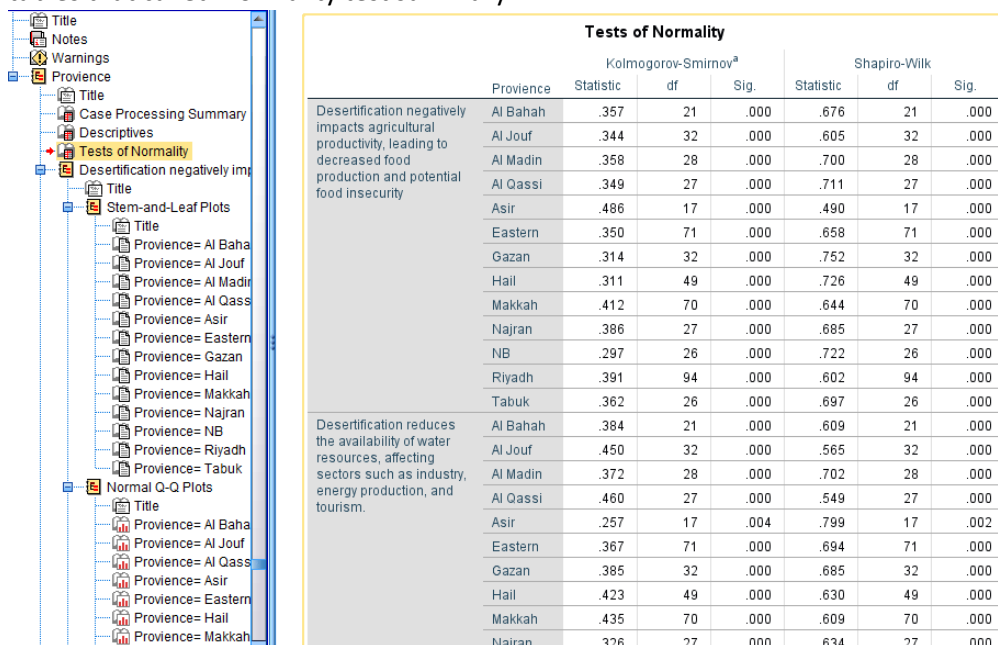


Figure 27 Tests of Normality outcome

Q1:

Province		Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Q1	Al Bahah	0.357	21	0.000	0.676	21	0.000
	Al Jouf	0.344	32	0.000	0.605	32	0.000
	Al Madin	0.358	28	0.000	0.700	28	0.000
	Al Qassi	0.349	27	0.000	0.711	27	0.000
	Asir	0.486	17	0.000	0.490	17	0.000
	Eastern	0.350	71	0.000	0.658	71	0.000
	Gazan	0.314	32	0.000	0.752	32	0.000
	Hail	0.311	49	0.000	0.726	49	0.000
	Makkah	0.412	70	0.000	0.644	70	0.000
	Najran	0.386	27	0.000	0.685	27	0.000
	NB	0.297	26	0.000	0.722	26	0.000
	Riyadh	0.391	94	0.000	0.602	94	0.000
	Tabuk	0.362	26	0.000	0.697	26	0.000

Table 25 Tests of Normality for Q1

Q2:

Province		Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Q2	Al Bahah	0.384	21	0.000	0.609	21	0.000
	Al Jouf	0.450	32	0.000	0.565	32	0.000
	Al Madin	0.372	28	0.000	0.702	28	0.000
	Al Qassi	0.460	27	0.000	0.549	27	0.000
	Asir	0.257	17	0.004	0.799	17	0.002
	Eastern	0.367	71	0.000	0.694	71	0.000
	Gazan	0.385	32	0.000	0.685	32	0.000
	Hail	0.423	49	0.000	0.630	49	0.000
	Makkah	0.435	70	0.000	0.609	70	0.000
	Najran	0.326	27	0.000	0.634	27	0.000
	NB	0.357	26	0.000	0.718	26	0.000
	Riyadh	0.375	94	0.000	0.696	94	0.000
	Tabuk	0.474	26	0.000	0.524	26	0.000

Table 26 Tests of Normality for Q2

Q3:

Province		Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Q3	Al Bahah	0.289	21	0.000	0.803	21	0.001
	Al Jouf	0.386	32	0.000	0.568	32	0.000
	Al Madin	0.310	28	0.000	0.761	28	0.000
	Al Qassi	0.449	27	0.000	0.588	27	0.000
	Asir	0.271	17	0.002	0.778	17	0.001
	Eastern	0.351	71	0.000	0.725	71	0.000
	Gazan	0.313	32	0.000	0.697	32	0.000
	Hail	0.375	49	0.000	0.638	49	0.000
	Makkah	0.388	70	0.000	0.682	70	0.000
	Najran	0.366	27	0.000	0.708	27	0.000
	NB	0.317	26	0.000	0.675	26	0.000
	Riyadh	0.294	94	0.000	0.780	94	0.000
	Tabuk	0.419	26	0.000	0.633	26	0.000

Table 27 Tests of Normality for Q3

Q4:

Province		Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Q4	Al Bahah	0.332	21	0.000	0.728	21	0.000
	Al Jouf	0.438	32	0.000	0.557	32	0.000
	Al Madin	0.298	28	0.000	0.734	28	0.000
	Al Qassi	0.446	27	0.000	0.583	27	0.000
	Asir	0.349	17	0.000	0.642	17	0.000
	Eastern	0.382	71	0.000	0.681	71	0.000
	Gazan	0.345	32	0.000	0.698	32	0.000
	Hail	0.451	49	0.000	0.584	49	0.000
	Makkah	0.411	70	0.000	0.635	70	0.000
	Najran	0.460	27	0.000	0.549	27	0.000
	NB	0.404	26	0.000	0.661	26	0.000
	Riyadh	0.370	94	0.000	0.630	94	0.000
	Tabuk	0.426	26	0.000	0.582	26	0.000

Table 28 Tests of Normality for Q4

Q5:

Province		Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Q5	Al Bahah	0.404	21	0.000	0.661	21	0.000
	Al Jouf	0.399	32	0.000	0.663	32	0.000
	Al Madin	0.379	28	0.000	0.675	28	0.000
	Al Qassi	0.419	27	0.000	0.626	27	0.000

	Asir	0.325	17	0.000	0.754	17	0.001
	Eastern	0.305	71	0.000	0.746	71	0.000
	Gazan	0.367	32	0.000	0.696	32	0.000
	Hail	0.398	49	0.000	0.579	49	0.000
	Makkah	0.360	70	0.000	0.658	70	0.000
	Najran	0.411	27	0.000	0.651	27	0.000
	NB	0.363	26	0.000	0.702	26	0.000
	Riyadh	0.325	94	0.000	0.693	94	0.000
	Tabuk	0.398	26	0.000	0.668	26	0.000

Table 29 Tests of Normality for Q5

Q6:

Province		Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Q6	Al Bahah	0.296	21	0.000	0.774	21	0.000
	Al Jouf	0.371	32	0.000	0.618	32	0.000
	Al Madin	0.331	28	0.000	0.744	28	0.000
	Al Qassi	0.466	27	0.000	0.539	27	0.000
	Asir	0.268	17	0.002	0.706	17	0.000
	Eastern	0.316	71	0.000	0.651	71	0.000
	Gazan	0.371	32	0.000	0.618	32	0.000
	Hail	0.372	49	0.000	0.623	49	0.000
	Makkah	0.388	70	0.000	0.680	70	0.000
	Najran	0.367	27	0.000	0.544	27	0.000
	NB	0.337	26	0.000	0.660	26	0.000
	Riyadh	0.326	94	0.000	0.719	94	0.000
	Tabuk	0.460	26	0.000	0.555	26	0.000

Table 30 Tests of Normality for Q6

Q7:

Province		Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Q7	Al Bahah	0.357	21	0.000	0.676	21	0.000
	Al Jouf	0.383	32	0.000	0.688	32	0.000
	Al Madin	0.320	28	0.000	0.763	28	0.000
	Al Qassi	0.446	27	0.000	0.583	27	0.000
	Asir	0.358	17	0.000	0.721	17	0.000
	Eastern	0.359	71	0.000	0.720	71	0.000
	Gazan	0.405	32	0.000	0.634	32	0.000
	Hail	0.374	49	0.000	0.611	49	0.000
	Makkah	0.352	70	0.000	0.670	70	0.000
	Najran	0.405	27	0.000	0.656	27	0.000
	NB	0.294	26	0.000	0.758	26	0.000

	Riyadh	0.342	94	0.000	0.719	94	0.000
	Tabuk	0.423	26	0.000	0.633	26	0.000

Table 31 Tests of Normality for Q7

Q8:

Province		Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Q8	Al Bahah	0.353	21	0.000	0.649	21	0.000
	Al Jouf	0.439	32	0.000	0.606	32	0.000
	Al Madin	0.429	28	0.000	0.591	28	0.000
	Al Qassi	0.402	27	0.000	0.586	27	0.000
	Asir	0.358	17	0.000	0.721	17	0.000
	Eastern	0.353	71	0.000	0.698	71	0.000
	Gazan	0.403	32	0.000	0.590	32	0.000
	Hail	0.379	49	0.000	0.685	49	0.000
	Makkah	0.379	70	0.000	0.642	70	0.000
	Najran	0.386	27	0.000	0.685	27	0.000
	NB	0.376	26	0.000	0.697	26	0.000
	Riyadh	0.352	94	0.000	0.707	94	0.000
	Tabuk	0.508	26	0.000	0.436	26	0.000

Table 32 Tests of Normality for Q8

Q9:

Province		Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Q9	Al Bahah	0.339	21	0.000	0.629	21	0.000
	Al Jouf	0.451	32	0.000	0.577	32	0.000
	Al Madin	0.365	28	0.000	0.655	28	0.000
	Al Qassi	0.430	27	0.000	0.553	27	0.000
	Asir	0.324	17	0.000	0.752	17	0.000
	Eastern	0.338	71	0.000	0.665	71	0.000
	Gazan	0.450	32	0.000	0.565	32	0.000
	Hail	0.364	49	0.000	0.709	49	0.000
	Makkah	0.400	70	0.000	0.652	70	0.000
	Najran	0.423	27	0.000	0.597	27	0.000
	NB	0.357	26	0.000	0.718	26	0.000
	Riyadh	0.328	94	0.000	0.742	94	0.000
	Tabuk	0.359	26	0.000	0.640	26	0.000

Table 33 Tests of Normality for Q9

Q10:

Province		Kolmogorov-Smirnov ^a	df	Sig.	Shapiro-Wilk	df	Sig.
		Statistic			Statistic		
Q10	Al Bahah	0.356	21	0.000	0.641	21	0.000
	Al Jouf	0.423	32	0.000	0.632	32	0.000
	Al Madin	0.293	28	0.000	0.711	28	0.000
	Al Qassi	0.374	27	0.000	0.696	27	0.000
	Asir	0.325	17	0.000	0.754	17	0.001
	Eastern	0.384	71	0.000	0.675	71	0.000
	Gazan	0.386	32	0.000	0.613	32	0.000
	Hail	0.327	49	0.000	0.649	49	0.000
	Makkah	0.419	70	0.000	0.622	70	0.000
	Najran	0.391	27	0.000	0.675	27	0.000
	NB	0.315	26	0.000	0.749	26	0.000
	Riyadh	0.341	94	0.000	0.652	94	0.000
	Tabuk	0.462	26	0.000	0.558	26	0.000

Table 34 Tests of Normality for Q10

- After the testing, now will compute Skewness and Kurtosis:
Here will use the previous way to find the descriptive statistics but different selection.

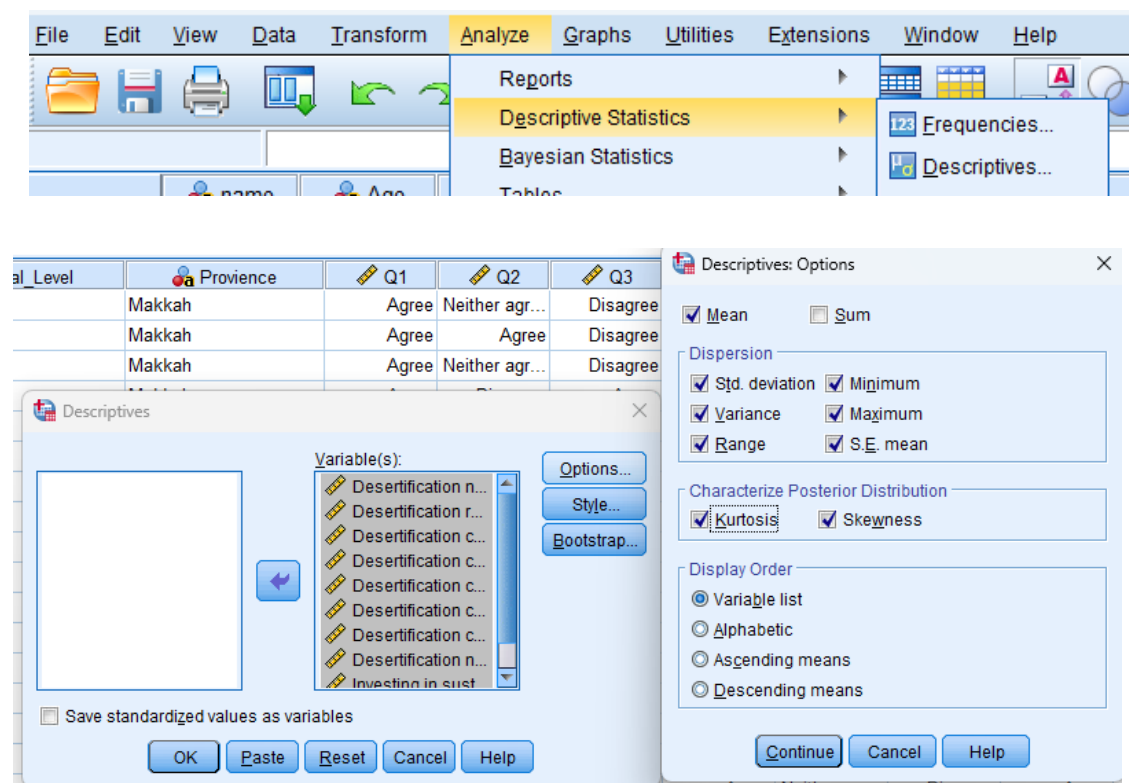


Figure 28 Skewness and Kurtosis steps

Descriptive Statistics												
	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness	Kurtosis			
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Std. Error	Statistic	Std. Error	
Desertification negatively impacts agricultural productivity, leading to decreased food production and potential food insecurity	520	4	1	5	4.49	.034	.785	.616	-1.844	.107	3.907	.214
Desertification reduces the availability of water resources, affecting sectors such as industry, energy production, and tourism.	520	4	1	5	4.57	.028	.647	.419	-1.538	.107	2.607	.214
Desertification contributes to increased poverty rates as it reduces livelihood opportunities for communities dependent on agriculture and natural resources	520	4	1	5	4.41	.037	.835	.697	-1.531	.107	2.315	.214
Desertification can lead to increased conflicts over scarce resources, such as land and water, which can disrupt economic activities and hinder development.	520	4	1	5	4.54	.034	.767	.588	-1.964	.107	4.106	.214
Desertification can lead to increased rural-urban migration, exacerbating unemployment and	520	4	1	5	4.45	.036	.822	.676	-1.720	.107	3.173	.214

Figure 29 Screenshot of Skewness and Kurtosis Outcome

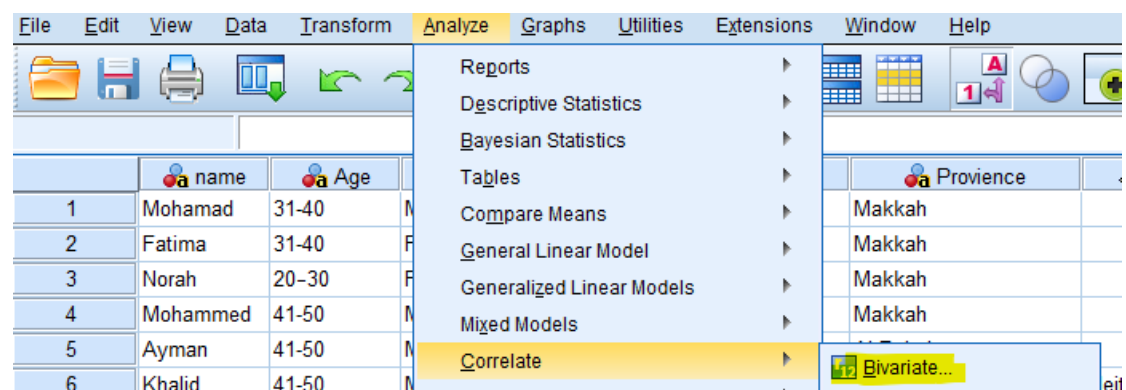
Here is a table that provided all Skewness and Kurtosis Outcome of data (Using EXCEL) to showing all columns:

Descriptive Statistics												
	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness	Kurtosis			
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Std. Error	Statistic	Std. Error	
Q1	520	4	1	5	4.49	0.034	0.785	0.616	-1.844	0.107	3.907	0.214
Q2	520	4	1	5	4.57	0.028	0.647	0.419	-1.538	0.107	2.607	0.214
Q3	520	4	1	5	4.41	0.037	0.835	0.697	-1.531	0.107	2.315	0.214
Q4	520	4	1	5	4.54	0.034	0.767	0.588	-1.964	0.107	4.106	0.214
Q5	520	4	1	5	4.45	0.036	0.822	0.676	-1.720	0.107	3.173	0.214
Q6	520	4	1	5	4.49	0.034	0.768	0.589	-1.910	0.107	4.767	0.214
Q7	520	4	1	5	4.46	0.035	0.796	0.634	-1.573	0.107	2.380	0.214
Q8	520	4	1	5	4.53	0.033	0.757	0.574	-1.875	0.107	3.888	0.214
Q9	520	4	1	5	4.48	0.035	0.802	0.643	-1.827	0.107	3.769	0.214
Q10	520	4	1	5	4.51	0.034	0.765	0.586	-2.013	0.107	5.060	0.214
Valid N (listwise)	520											

Table 35 Skewness and Kurtosis Outcome

- After that, here is to find the correlation between the variables:

The steps of the correlation are:



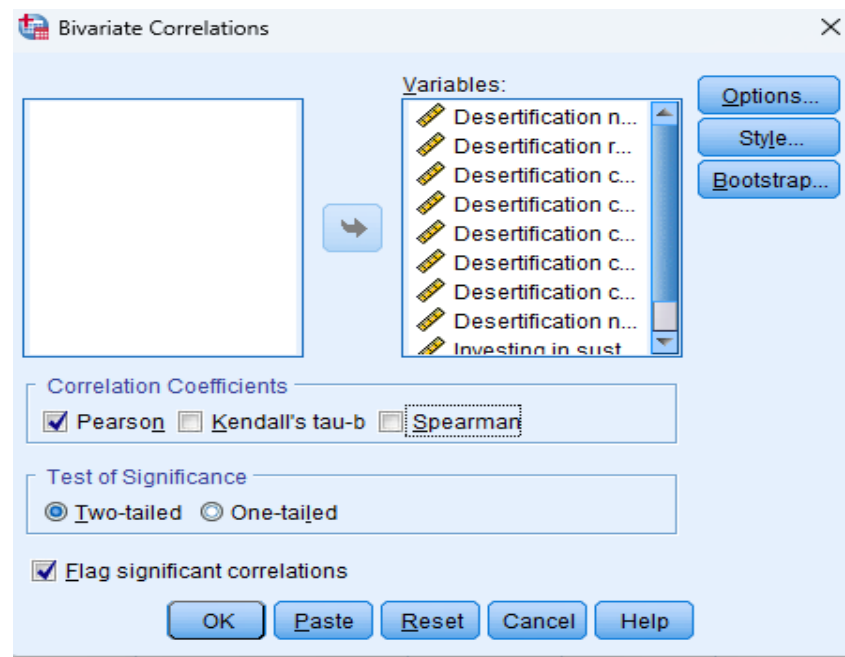


Figure 30 Correlation steps

Correlations									
		Desertification negatively impacts agricultural productivity, leading to decreased food production and potential food insecurity	Desertification reduces the availability of water resources, affecting sectors such as industry, energy production, and tourism.	Desertification contributes to increased poverty rates as it reduces livelihood opportunities for communities dependent on agriculture and natural resources	Desertification can lead to increased conflicts over scarce resources, such as land and water, which can disrupt economic activities and hinder development.	Desertification can lead to increased rural-urban migration, exacerbating unemployment and poverty in urban areas.	Desertification can lead to the displacement of rural populations, putting pressure on urban areas and straining social services and infrastructure.	Desertification can hinder economic development and foreign investment, as it creates an unfavorable business environment and limits the potential for sustainable growth.	Desertification negatively impacts biodiversity and ecosystem services, which can have economic consequences such as decreased tourism revenue and loss of potential pharmaceutical resources.
Desertification negatively impacts agricultural productivity, leading to decreased food production and potential food insecurity	Pearson Correlation	1	.146**	.260**	.146**	.187**	.265**	.156**	.116**
	Sig. (2-tailed)		.001	.000	.001	.000	.000	.000	.008
	N	520	520	520	520	520	520	520	520
Desertification reduces the availability of water resources, affecting sectors such as industry, energy production, and tourism.	Pearson Correlation	.146**	1	.608**	.548**	.445**	.479**	.480**	.388**
	Sig. (2-tailed)	.001		.000	.000	.000	.000	.000	.000
	N	520	520	520	520	520	520	520	520
Desertification contributes to increased poverty rates as it reduces livelihood	Pearson Correlation	.260**	.608**	1	.579**	.488**	.648**	.467**	.374**
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000	.000

Figure 31 Correlation outcome

Here is the table of the correlation outcome for the ten questions in the survey:

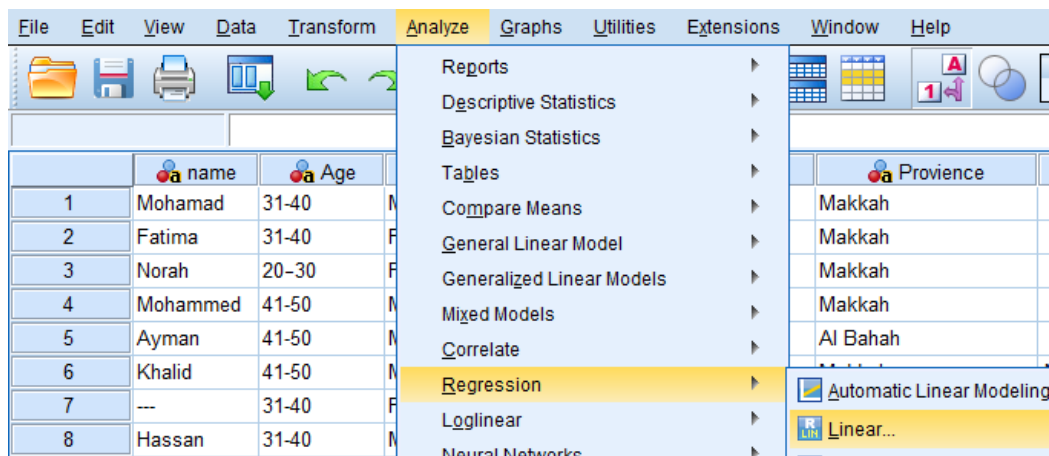
Correlations											
		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Q1	Pearson Correlation	1	.146**	.260**	.146**	.187**	.265**	.156**	.116**	.165**	.153**
	Sig. (2-tailed)		0.001	0.000	0.001	0.000	0.000	0.000	0.008	0.000	0.000
	N	520	520	520	520	520	520	520	520	520	520
Q2	Pearson Correlation	.146**	1	.608**	.548**	.445**	.479**	.480**	.388**	.278**	.510**
	Sig. (2-tailed)	0.001		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	520	520	520	520	520	520	520	520	520	520

Q3	Pearson Correlation	.260**	.608**	1	.579**	.488**	.648**	.467**	.374**	.374**	.470**
	Sig. (2-tailed)	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	520	520	520	520	520	520	520	520	520	520
Q4	Pearson Correlation	.146**	.548**	.579**	1	.497**	.477**	.421**	.340**	.235**	.397**
	Sig. (2-tailed)	0.001	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000
	N	520	520	520	520	520	520	520	520	520	520
Q5	Pearson Correlation	.187**	.445**	.488**	.497**	1	.500**	.300**	.353**	.165**	.342**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000
	N	520	520	520	520	520	520	520	520	520	520
Q6	Pearson Correlation	.265**	.479**	.648**	.477**	.500**	1	.466**	.456**	.353**	.471**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
	N	520	520	520	520	520	520	520	520	520	520
Q7	Pearson Correlation	.156**	.480**	.467**	.421**	.300**	.466**	1	.604**	.478**	.619**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000
	N	520	520	520	520	520	520	520	520	520	520
Q8	Pearson Correlation	.116**	.388**	.374**	.340**	.353**	.456**	.604**	1	.462**	.512**
	Sig. (2-tailed)	0.008	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000
	N	520	520	520	520	520	520	520	520	520	520
Q9	Pearson Correlation	.165**	.278**	.374**	.235**	.165**	.353**	.478**	.462**	1	.507**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000
	N	520	520	520	520	520	520	520	520	520	520
Q10	Pearson Correlation	.153**	.510**	.470**	.397**	.342**	.471**	.619**	.512**	.507**	1
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
	N	520	520	520	520	520	520	520	520	520	520

Figure 32 Correlation outcome for the ten questions

- Then, another way used to measure the multicollinearity through calculating Variance

Inflation Factor (VIF):



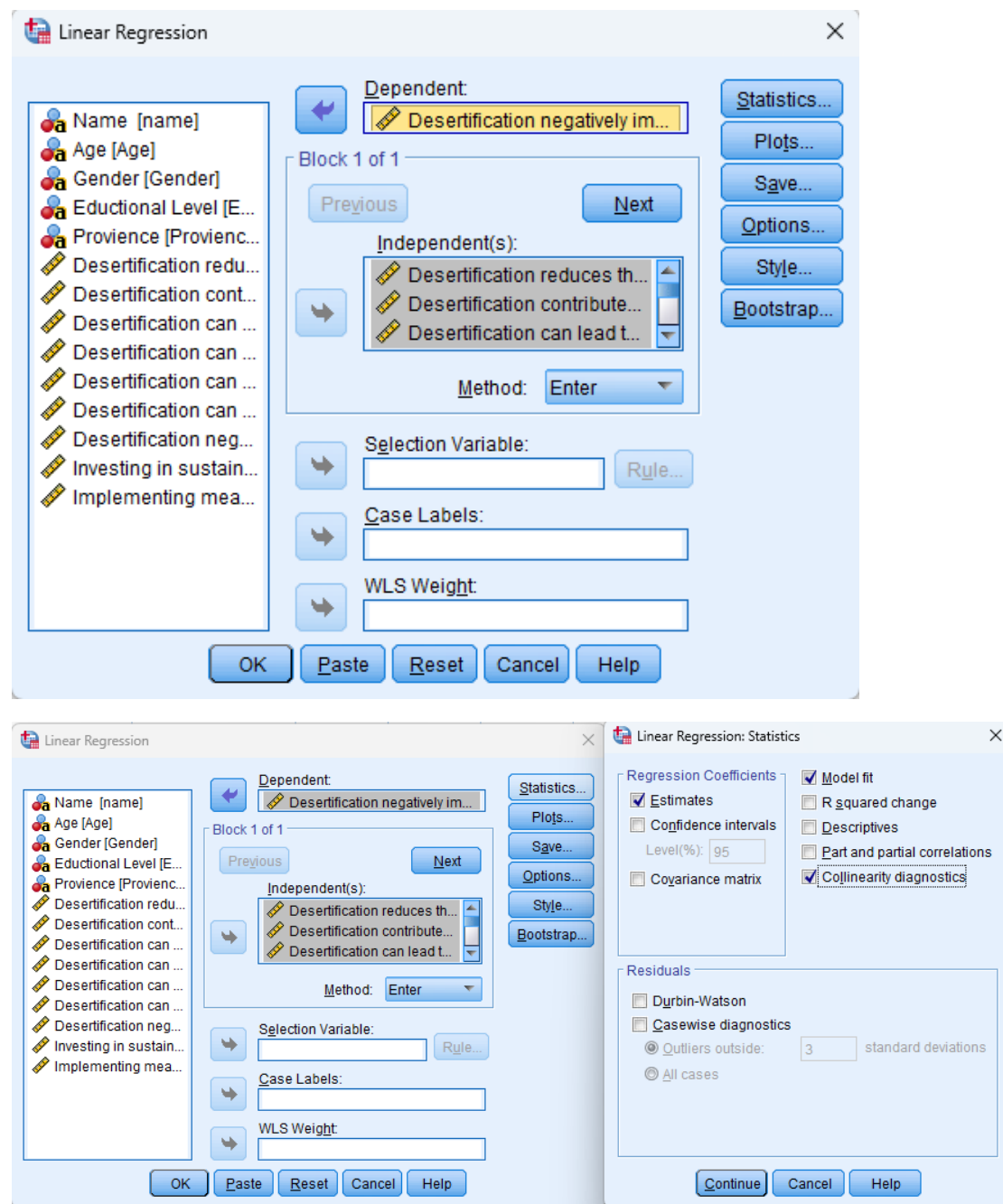


Figure 33 VIF steps

- Then, the outcome of VIF includes three parts:

1st Part: Model summary, as seen in the figure (34)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.305 ^a	.093	.077	.754

Figure 34 Model Summary

2nd Part: ANOVA, as seen in the figure (35)

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	29.737	9	3.304	5.807	.000 ^b
	Residual	290.194	510	.569		
	Total	319.931	519			

Figure 35 ANOVA

3rd Part: Coefficients, as seen in the below table (36)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	Q1:(Constant)	3.078	0.291		10.576	0.000		
	Q2	-0.052	0.072	-0.043	-0.732	0.465	0.509	1.963
	Q3	0.144	0.062	0.153	2.336	0.020	0.413	2.420
	Q4	-0.038	0.058	-0.037	-0.660	0.509	0.554	1.806
	Q5	0.071	0.051	0.074	1.386	0.166	0.624	1.602
	Q6	0.161	0.062	0.158	2.609	0.009	0.488	2.050
	Q7	0.030	0.061	0.031	0.495	0.621	0.462	2.165
	Q8	-0.062	0.059	-0.060	-1.048	0.295	0.546	1.832
	Q9	0.077	0.051	0.079	1.498	0.135	0.645	1.552
	Q10	-0.011	0.062	-0.010	-0.173	0.863	0.490	2.039

Table 36 Coefficients table

- Then, preform Bartlett of sphericity Test, the process is provided in the figure (**).

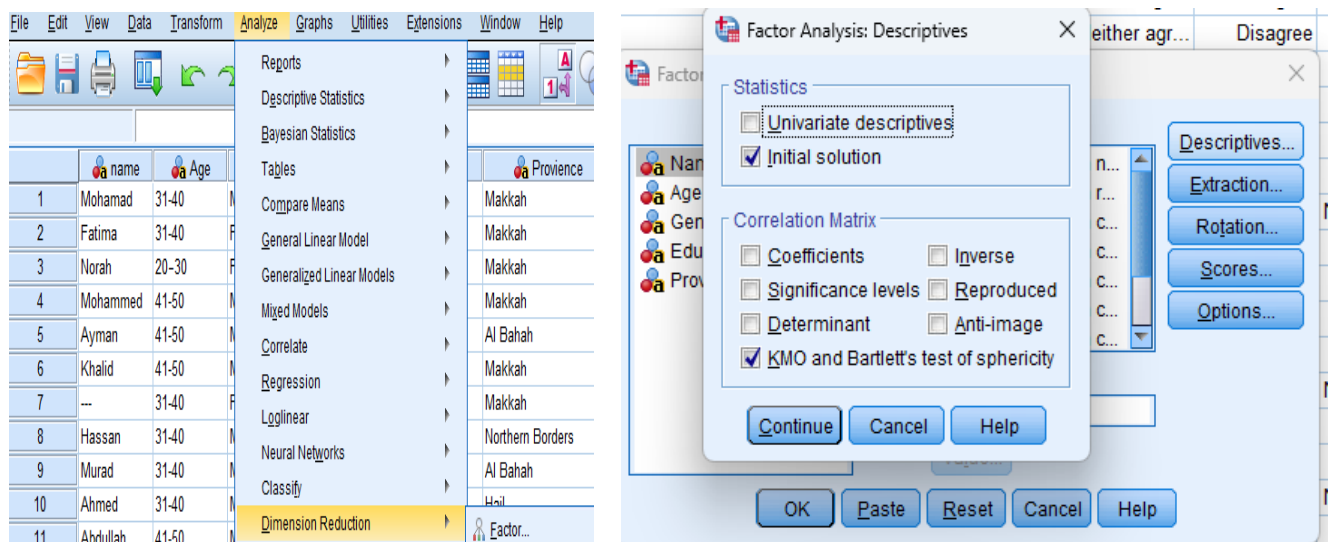


Figure 36 Bartlett of sphericity Test Steps

After that, the result will displayed in the outcome page, as shown in below.

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.890
Bartlett's Test of Sphericity	Approx. Chi-Square	2108.127
	df	45
	Sig.	.000

Figure 37 Bartlett of sphericity Test outcome

Chapter 6

(Findings Discussion)

Introduction

We distributed (615) questionnaires to respondents of the research population, there are (95) questionnaires were excluded because they were not suitable for analysis. Accordingly, the number of questionnaires completed and ready for analysis became (520) questionnaires. In current chapter will discuss more about the questionnaire and the research sample.

Validity

KMO of at least 0.80 are good enough for factor analysis to commence. So, The KMO value here shows having an excellent measure (0.890) as shown in the figure (38)

And Bartlett's test of Sphericity is 0.000 ($p < 0.001$) that means there is a highly significant relationship among the variables in measuring the variables under study.

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.890
Bartlett's Test of Sphericity	Approx. Chi-Square	2108.127
	df	45
	Sig.	.000

Figure 38 KMO and Bartlett's test Outcome

Reliability

The value of Cronbach's Alpha is 0.868 to have very good reliability (above 0.6).

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.865	.866	10

Figure 39 Reliability result

- The following table shows the numbers and percentages of received, excluded, and completed questionnaires for the research population.

Regions	Received		Completed		Excluded	
	No	%	No	%	No	%
Makkah	89	14.4%	70	13.5%	19	20.0%
Al Bahah	25	4.0%	21	4.0%	4	4.2%
Asir	25	4.0%	17	3.3%	8	8.4%
Riyadh	134	21.7%	94	18.1%	40	42.0%
Najran	30	4.8%	27	5.2%	3	3.1%
Jazan	37	6.0%	32	6.2%	5	5.2%
Hail	51	8.2%	49	9.4%	2	2.1%
Al Jouf	32	5.2%	32	6.2%	0	0.0%

Madina	28	4.5%	28	5.4%	0	0.0%
Tabuk	33	5.3%	26	5.0%	7	7.3%
Eastern	75	12.1%	71	13.7%	4	4.2%
Northern boarder	28	4.5%	26	5.0%	2	2.1%
Al Qassim	28	4.5%	27	5.0%	1	1.0%
TOTAL	615	100%	520	100%	95	100%

Table 37 Numbers of received, excluded, and completed questionnaires for the research population

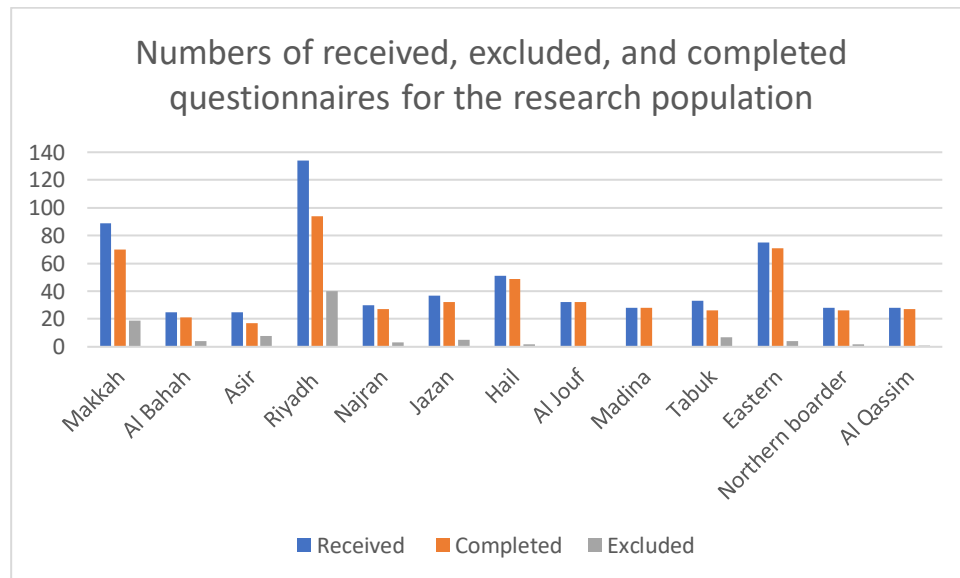


Figure 40 The Numbers of received, excluded, and completed questionnaires for the research population

Demographic characteristics of the research sample respondents

The general information included in the questionnaire, which enables the respondents of the research sample to be classified as follows:

- **Sample respondents by Gender:**

It is noted from Table (38) that most of the research sample respondents are male, as their percentage reached 63.8%, while the percentage of females reached 36.2%.

Gender	Numbers	%
Male	332	63.8%
Female	188	36.2%
Total	520	100%

Table 38 Sample respondents by Gender

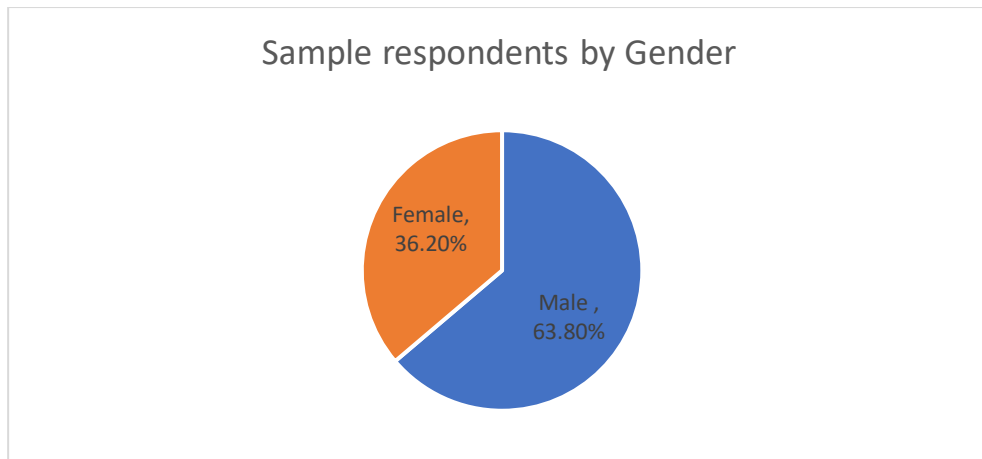


Figure 41 Sample respondents by Gender

▪ Sample respondents by Age:

Table (39) proved that most of the research sample participants belong to the age group from 20 to 30 years, where their percentage reached 49.4%. The percentage of respondents of the research sample who are between the ages of 31 and 40 years old was 23.7%, and the percentage of participants in the research sample who were between the ages of 41 and 50 years was 22.3%, while the percentage of respondents in the research sample who were between the ages of 51 and above was 4.6%.

Age	Numbers	%
20 – 30	257	49.4%
31 – 40	123	23.7%
41 – 50	116	22.3%
51 & Above	24	4.6%
Total	520	100%

Table 39 Sample respondents by Age

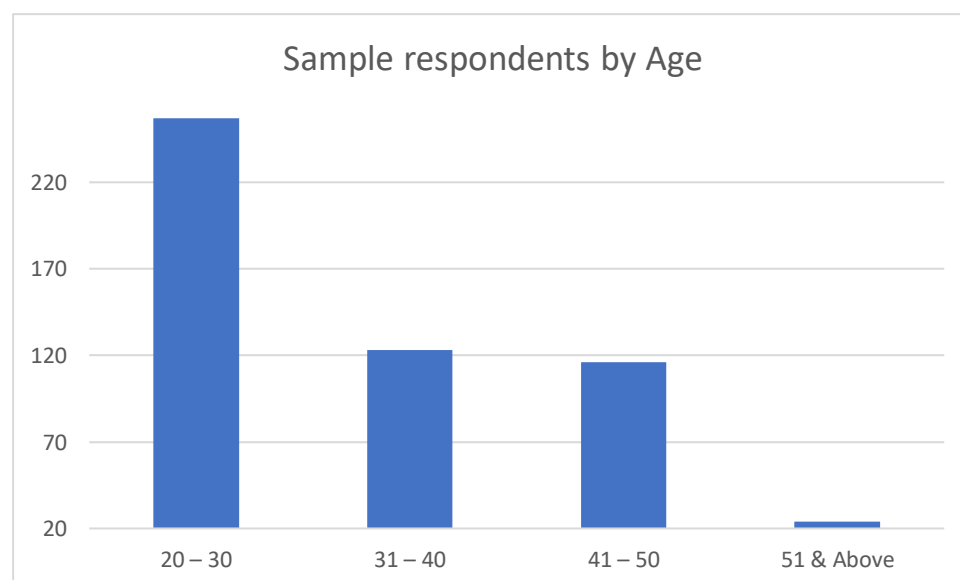


Figure 42 Sample respondents by Age

▪ Sample respondents by Educational Level:

It is mentioned in Table (40) that most of the participants of the research sample are those who obtained a postgraduate degree (Master's or PHD), where their percentage reached 68.8%, and the percentage of participants of the research sample who obtained a bachelor's degree was 18.3%, and the percentage of individuals in the research sample who obtained a diploma was 5.6%, while the percentage of individuals in the research sample who held a high school diploma was 7.3%.

Educational Level	Numbers	%
High School	38	7.3%
Diploma	29	5.6%
Undergraduate	95	18.3%
Postgraduate	358	68.8%
Total	520	100%

Table 40 Sample respondents by Educational Level

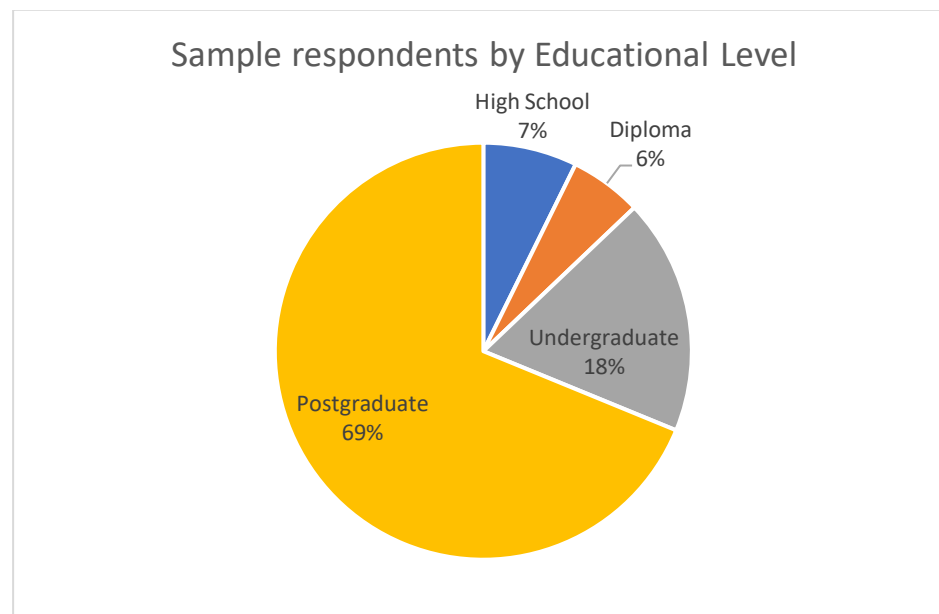


Figure 43 Sample respondents by Educational Level

▪ Sample respondents by Province:

It is noted from Table (41) that most of the individuals in the research sample are from Riyadh region, where their percentage reached 18.1%, and the percentage of individuals in the research sample from Makkah region reached 13.5%, and the percentage of individuals in the research sample is 13.7% in Eastern region, while the percentage of individuals in the research sample is from other regions in similar proportions from each other.

Province	Numbers	%
Makkah Region	70	13.5%
Al Bahah Region	21	4.0%
Asir	17	3.3%

Riyadh	94	18.1%
Najran	27	5.2%
Jazan	32	6.2%
Hail	49	9.4%
Aljouf	32	6.2%
Madina	28	5.4%
Tabuk	26	5.0%
Eastern	71	13.7%
Northern boarder	26	5.0%
Al Qassim	27	5.0%
Total	520	100%

Table 41 Sample respondents by Province

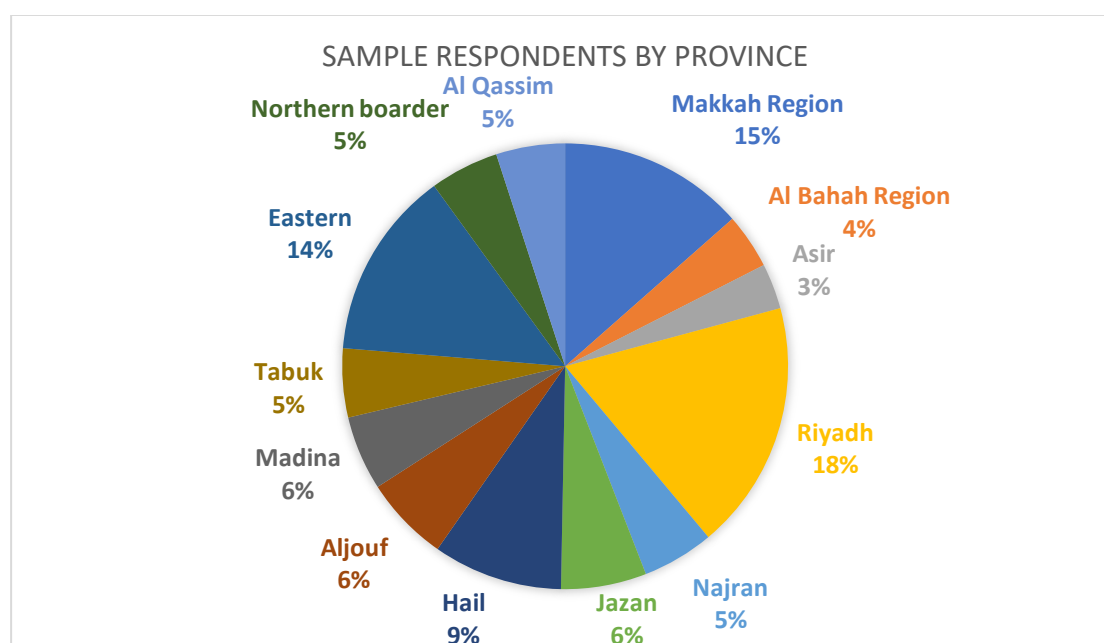


Figure 44 Sample respondents by Province

Research Questions (PART2:10-Q)

To answer the Research's questions, a questionnaire was built that included the research variables, and it was applied to the study's (520) participants according to the previously mentioned objective. The data was entered into the computer and using the statistical program SPSS, also We used Likert scale (Strongly disagree – Disagree – Neither/Nor Agree – Agree – Strongly agree) for the second part of the survey to measure respondents' attitudes by asking the extent to which they disagree or neither agree nor disagree or agree with a particular question. (There are 10 Questions which are Closed-end Questions) . The results were analysed and were as follows:

- This point as reminder to the coding: Before insert the table of descriptive statistics for each question, there is a code for each question due to the long for each question.

Question	Code
Desertification negatively impacts agricultural productivity, leading to decreased food production and potential food insecurity	Q1
Desertification reduces the availability of water resources, affecting sectors such as industry, energy production, and tourism.	Q2
Desertification contributes to increased poverty rates as it reduces livelihood opportunities for communities dependent on agriculture and natural resources	Q3
Desertification can lead to increased conflicts over scarce resources, such as land and water, which can disrupt economic activities and hinder development.	Q4
Desertification can lead to increased rural-urban migration, exacerbating unemployment and poverty in urban areas.	Q5
Desertification can lead to the displacement of rural populations, putting pressure on urban areas and straining social services and infrastructure.	Q6
Desertification can hinder economic development and foreign investment, as it creates an unfavorable business environment and limits the potential for sustainable growth.	Q7
Desertification negatively impacts biodiversity and ecosystem services, which can have economic consequences such as decreased tourism revenue and loss of potential pharmaceutical resources.	Q8
Investing in sustainable land management practices can help mitigate desertification and provide economic benefits through increased agricultural productivity and job creation.	Q9
Implementing measures to combat desertification, such as reforestation and sustainable land management, can create green job opportunities and stimulate economic growth.	Q10

Table 42 Coding for questions

- In addition, Using Likert Scale to measuring the agreement and frequencies, the values (weights) were calculated as in the following table:

Likert-Scale Description	Weight/value
Strongly disagree	1
Disagree	2
Neither/Nor agree	3
Agree	4
Strongly agree	5

Table 43 Likert scale weights

Then the direction is determined for the scale as in the following table:

Likert-Scale Description	Likert-Scale Interval
Strongly disagree	1.00 to 1.80
Disagree	1.81 to 2.60
Neither/Nor agree	2.61 to 3.40
Agree	3.41 to 4.20
Strongly agree	4.21 to 5.00

Table 44 Likert-Scale Interval

- Here is a table of descriptive statistics for each question based on the previous standards:

Question	Mean	Std. Deviation	Ranking	Response level
Q1	4.49	0.785	5	Strongly agree
Q2	4.57	0.647	1	Strongly agree
Q3	4.41	0.835	9	Strongly agree
Q4	4.54	0.767	2	Strongly agree
Q5	4.45	0.822	8	Strongly agree
Q6	4.49	0.768	5	Strongly agree
Q7	4.46	0.796	7	Strongly agree
Q8	4.53	0.757	3	Strongly agree
Q9	4.48	0.802	6	Strongly agree
Q10	4.51	0.765	4	Strongly agree
				Strongly agree

Table 45 Descriptive Statistics for each question

It is clear from Table (45) that the averages for the questionnaire questions about the relationship of desertification to the economy of the Kingdom of Saudi Arabia ranged between (4.41 – 4.57), with of Likert-Scale description “**Strongly AGREE**” for all questions.

Research Questions (PART3:1-Q)

The open question is about What are the recommended strategies to eliminate and reduce the effects of desertification?

The common recommended strategies such as:

1. Planting more tree.
2. Cloud Seeding.
3. Raising Society’s awareness regarding dealing with the desertification.

From our opinion, we strongly agree with the respondents’ opinion especially the third one because the awareness is the essential step to solve and fix any issue.

Hypothesis testing result

we accept the Alternative hypothesis that is There is a significant relationship between desertification and the country's economy due to the previous result.

Chapter 7

(Conclusion, Recommendations & Future Research)

Conclusion

After studying the relationship between desertification and the economy of KSA from the previous studies and theoretical side, and after distributing the questionnaire and analyzing its results, it became clear that there is a strong relationship linking desertification and the economy, as desertification affects several important aspects and factors contributing to the rise and fall of the economic aspect, such as tourism, agriculture, and production. As well as employment, and for the factors (Human activities and climates changes). Based on the participants' suggestions, it is necessary to raise community awareness because it is the basis for getting rid of desertification or mitigating the effects of desertification. Moreover, planting more and rain seeding contribute to mitigate the effects of desertification.

Recommendations

Based on the findings of this study, we recommend the following:

- ✧ Educating society about desertification, its effects, and the importance of adhering to available plans to mitigate its effects.
- ✧ Paying attention to educational programs and activities by the competent authorities.
- ✧ Activating the role of volunteerism that contributes to improving the environment.
- ✧ Rain seeding and afforestation are essential in alleviating desertification.

Future research

While the current study provides valuable insights into the correlation between desertification and economic growth in Saudi Arabia, there are several potential research avenues that can expand our understanding and inform more comprehensive strategies. These areas of future research include:

1. Long-term economic impacts: Subsequent research could focus on investigating the long-term economic benefits and sustainability of desertification mitigation strategies. This entails assessing factors such as the durability of restored ecosystems, maintenance costs, and the resilience of local communities over extended periods.
2. Social and human impacts: While this study primarily examines the economic aspects, future research could explore the social and human impacts of desertification in Saudi Arabia. This could involve analyzing the effects of desertification on local communities, including aspects such as displacement, changes in social structures, and impacts on health and well-being. Such research would provide a more holistic understanding of the multidimensional impacts of desertification.
3. Climate change adaptation and resilience: Given the anticipated exacerbation of desertification by climate change, future research could explore the intersection between climate change adaptation, resilience-building, and desertification mitigation. This could involve assessing the economic costs and benefits of integrating climate change adaptation measures into desertification mitigation strategies and identifying synergies between these two areas. The current knowledge able to provide evidence-based strategies that promote sustainable development, enhance resilience, and protect the natural resources and livelihoods of the country's communities.

Summary

It was determined that there is a strong correlation between desertification and the economy after looking at the relationship between the two from theoretical and previous studies, as well as after distributing the questionnaire and analyzing the results. These factors include production, tourism, and agriculture, among other significant aspects that are impacted by desertification. In addition, employment rate and the causes (changes in climate and human activity) are considered. Furthermore, as per the recommendations made by the participants, increasing community knowledge is essential as it serves as the foundation for eliminating or lessening the consequences of desertification, then the rain seeding and .

المخلص

بعد دراسة العلاقة بين التصحر واقتصاد المملكة العربية السعودية من الدراسات السابقة والجانب النظري، و من خلال توزيع الاستبيان وتحليله والنتائج التي تم التوصل إليها من قبل الاستبانة، تبين أن هناك علاقة قوية تربط بين التصحر والاقتصاد، حيث يؤثر التصحر على عدة جوانب مهمة منها صحية ومنها اجتماعية وأيضاً اقتصادية وهناك مجالات متأثرة بالتصحر وبالوقت ذاته تؤثر في صعود وهبوط الجانب الاقتصادي، كالسياحة والزراعة والإنتاج. وكذلك معدل التوظيف. و علاوة على ذلك فإن هنالك عاملين رئيسيين مؤثرة على التصحر وهي: الأنشطة البشرية والتغيرات المناخية. لذا توصل هذا البحث إلى أنه من الضروري رفع الوعي المجتمع بما يخص التصحر وكيفية التعاون في تحسين البيئة لأنه يعتبر الخطوة الأولى للتخلص من التصحر أو التخفيف من آثار التصحر ثم بعد ذلك يأتي دور الجهات المختصة بما يخص التشجير والاستمطار.

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Appendix

Appendix 1:

Questionnaire

Dear participants

Greetings!

I am pleased to put in your hands a questionnaire for a scientific study entitled
" Study of The Impacts of Desertification on Economic aspect in The Kingdom of
Saudi Arabia

This is in continuation of the requirements for obtaining a master's degree in risk
management, as this study aims to

To reveal the extent of the impact of desertification on the economy of Saudi Arabia.

Kindly, we would like you to contribute to this study by filling out the attached
questionnaire, as the data to be collected will be important for the success of the
research, and we would also like to assure you that the data is used for scientific
research purposes only.

Thank you in advance!

Kind regards

Part 1 - Personal Details

This part includes (5) general questions about the respondents' details.

Name (Optional)

Gender:

Age:

Educational level:

Province:

Part 2 – the relationship between the desertification and economic aspect in Saudi Arabia

This part includes (10) main statements about the research objectives.

1. Desertification negatively impacts agricultural productivity, leading to decreased food production and potential food insecurity.

☐ Agree ☐ Neither agree nor disagree ☐ Disagree

2. Desertification can lead to the displacement of rural populations, putting pressure on urban areas and straining social services and infrastructure.

☐ Agree ☐ Neither agree nor disagree ☐ Disagree

3. Desertification reduces the availability of water resources, affecting sectors such as industry, energy production, and tourism.

☐ Agree ☐ Neither agree nor disagree ☐ Disagree

4. Investing in sustainable land management practices can help mitigate desertification and provide economic benefits through increased agricultural productivity and job creation.

☐ Agree ☐ Neither agree nor disagree ☐ Disagree

5. Desertification can hinder economic development and foreign investment, as it creates an unfavorable business environment and limits the potential for sustainable growth.

☐ Agree ☐ Neither agree nor disagree ☐ Disagree

6. Desertification contributes to increased poverty rates as it reduces livelihood opportunities for communities dependent on agriculture and natural resources.

☐ Agree ☐ Neither agree nor disagree ☐ Disagree

7. Desertification can lead to increased rural-urban migration, exacerbating unemployment and poverty in urban areas.

☐ Agree ☐ Neither agree nor disagree ☐ Disagree

8. Desertification negatively impacts biodiversity and ecosystem services, which can have economic consequences such as decreased tourism revenue and loss of potential pharmaceutical resources.

☐ Agree ☐ Neither agree nor disagree ☐ Disagree

9. Desertification can lead to increased conflicts over scarce resources, such as land and water, which can disrupt economic activities and hinder development.

☐ Agree ☐ Neither agree nor disagree ☐ Disagree

10. Implementing measures to combat desertification, such as reforestation and sustainable land management, can create green job opportunities and stimulate economic growth.

☐ Agree ☐ Neither agree nor disagree ☐ Disagree

Part 3 – Respondents' opinion

This part includes (1) open-end question for the respondents' opinion

What are the recommended strategies to eliminate and reduce the effects of desertification?

Appendix 2:

Experts and Specialists List

(Study of The Impacts of Desertification on Economic aspect in The Kingdom of Saudi Arabia)

	Expert Name	Position
1	Stephanie Brookes	Researcher
2	Sam Jahnsen	Data Analyst
3	Sophia Stewart	Expert in Economics