



**Pre-Feasibility Study**  
**Establishing a Cut Flowers Farm**  
**Madaba**

April, 2017



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## Madaba Governorate



## 1. Executive Summary

The study aims at identifying the Pre-Feasibility of establishing a farm for producing cut flowers inside the green houses through the use of modern agricultural techniques, in addition to marketing and selling the production in the domestic market and export markets. The project is located in Theban area, Madaba Governorate, since it is a Shafa Ghuria area which is an arable environment suitable for flowers planting, endowed with extensive plains and fertile soil in addition to the availability of water sources, being near to Haidan Stream. The following table shows the preliminary indicators of the project.

**Table 1: Initial Indicators of the Project**

<b>Project Name</b>	The establishment of a farm for the production of cut flowers
<b>Sector</b>	Agriculture sector / agriculture production
<b>Governorate</b>	Madaba governorate
<b>Region</b>	Theban
<b>Products/Services</b>	<ul style="list-style-type: none"> <li>● Cut flowers (Roses and Carnation).</li> <li>● Bulbs of the cut flowers (Gladiolus, Tulip, Lilum, Narcissus...etc)</li> <li>● Annual flowers, chrysanthemum, Aster... etc.</li> <li>● Roses plant (propagation by cutting)</li> <li>● Bulbs cultivated in flasks.</li> </ul>
<b>Project Description</b>	The project is based on the establishment of a farm for the production of cut flowers in the green houses using the best state-of-the-art technologies of agriculture, to be marketed and sold in the local market and the exporting markets. The entire area of the farm is 35 dunums and the number of the employees is 29 employees.
<b>Target Market</b>	<ul style="list-style-type: none"> <li>● The Jordanian market in all governorates.</li> <li>● Exporting markets.</li> </ul>
<b>Investment Cost</b>	The investment cost of the project amounts to JD 1.4 million.
<b>The Average return on investment</b>	The Return on investment reaches 20.3% during the ten years.
<b>Internal Rate of Return</b>	Rate of return of the project reaches 20.8%
<b>Average added value of the project</b>	The added value of the project reaches 588 Thousand JD during ten years
<b>Risk Assessment</b>	The Sensitivity Analysis indicates a low risk in case of 10% increase in investment cost, or 10% increase in operating costs, or 10% decrease in revenues.
<b>The project Justifications</b>	<ul style="list-style-type: none"> <li>● Availability of the local raw materials in many places in Jordan.</li> <li>● The increasing local demand for cut flowers, particularly offices, hotels and restaurants.</li> <li>● The increasing external demand for cut flowers / increase of exports.</li> <li>● The increasing demand for the flowers especially the Roses and the</li> </ul>

	<p>other kinds.</p> <ul style="list-style-type: none"> <li>● Change of the quality of life and increasing demand for flowers in the rural and urban places.</li> <li>● Production of the cut flowers in a season otherwise their season (off season).</li> <li>● Roses are used in manufacturing many of the needed natural products which have healthy benefits which facilitates their marketing and exporting.</li> <li>● Seasonality, as they are increasingly demanded during the summer and the occasions.</li> <li>● Jordanian flowers are considered of the best kinds in the region.</li> </ul>
Partners/Stakeholders	<ul style="list-style-type: none"> <li>● Ministry of agriculture</li> <li>● Ministry of planning.</li> <li>● Water Authority.</li> <li>● Ministry of Industry and Trade.</li> </ul>

## 2. The Macroeconomic Environment

### 2.1 An Overview of the Hashemite Kingdom of Jordan

The Hashemite Kingdom of Jordan is a landlocked country surrounded by land except at its southern extremity at the port of Aqaba, where that area is the only sea exit area in Jordan. The Kingdom is bordered at its west side by Palestine and the Mediterranean Sea, at its south and east by the Kingdom of Saudi Arabia, at north east by Iraq and at north by Syria.

Figure 1: Map of the Hashemite Kingdom of Jordan



Jordan is marked by three climatic zones from west to east including the Jordan Valley, most of which lies below sea level and is considered subtropical, and upland areas to the east of the Jordan Valley, ranging in height from 100 to 1500 meters above sea level and this is one of the areas dominated by Mediterranean climate, and the desert areas stretching to the east of the highlands.

The total area of the Kingdom is approximately 89.3 thousand square kilometers, and the semi-desert conditions prevail in over 80% of this area where there are some wet lands settings like Azraq Basin.

The kingdom is divided administratively into twelve governorates distributed into three regions: the Northern Region (includes the governorates of Irbid, Ma'ana, Zarqa and Ajloun) while the Central Region (includes the governorates of the capital, Zarqa, Balqa, Madaba) and the Southern Region (includes the governorates of Karak, Tafila, Ma'an, Aqaba), and the major cities are Amman (the capital), Zarqa and Irbid.

## 2.2 Population

Based on the General Census of Population and Housing in 2015, the population in the kingdom amounted to about 9.5 million people with a population density of 107.3 inhabitants per km<sup>2</sup>, where the Capital City knocked off other governorates by population amounting to about 4 million people and a population density of 538.8 inhabitants per km<sup>2</sup>, mainly because Amman is the most attractive governorate for Jordanians and for those coming to Jordan from other countries, followed by Irbid Governorate with a population of 1.8 million people, and then Zarqa Governorate with a population of 1.4 million. Tafila Governorate which is considered to be the least populous governorate whose population is about 96 thousand people.

**Table 2: Number of population and population density in the Kingdom for 2015**

Governorate	Population (people)	Area (Km <sup>2</sup> )	Population density (people/ km <sup>2</sup> )
<b>Central Region</b>			
Capital	4007526	7,579	528.8
Zarqa	1364878	4761	286.7
Balqa	491709	1120	439.0
Madaba	189192	940	201.3
<b>North Region</b>			
Irbid	1770158	1572	1126.1
Mafraq	549948	26551	20.7
Jerash	237059	410	578.2
Ajloun	176080	420	419.2
<b>Southern Region</b>			
Karak	316629	3495	90.6
Tafeileh	96291	2209	43.6
Maan	144082	32832	4.4
Aqaba	188160	6905	27.2
<b>Total of Kingdom</b>	<b>9531712</b>	<b>88793.5</b>	<b>107.3</b>

Source: Department of Statistics, Jordan General Population and Housing Census, 2015

On the other hand, the population growth rate has reached about 3% in 2010 and increased to 9% during the years 2013 and 2014 and then dropped a little during 2015 to reach about 8%, according to demographic surveys for the Department of Statistics. The reason for the high growth rates is attributed to the influx of large numbers of refugees from Syria to the Kingdom which resulted in a marked decline in per capita real GDP index by 5.4% to JD 1,197.4, based on the Statements of the Central Bank of Jordan.

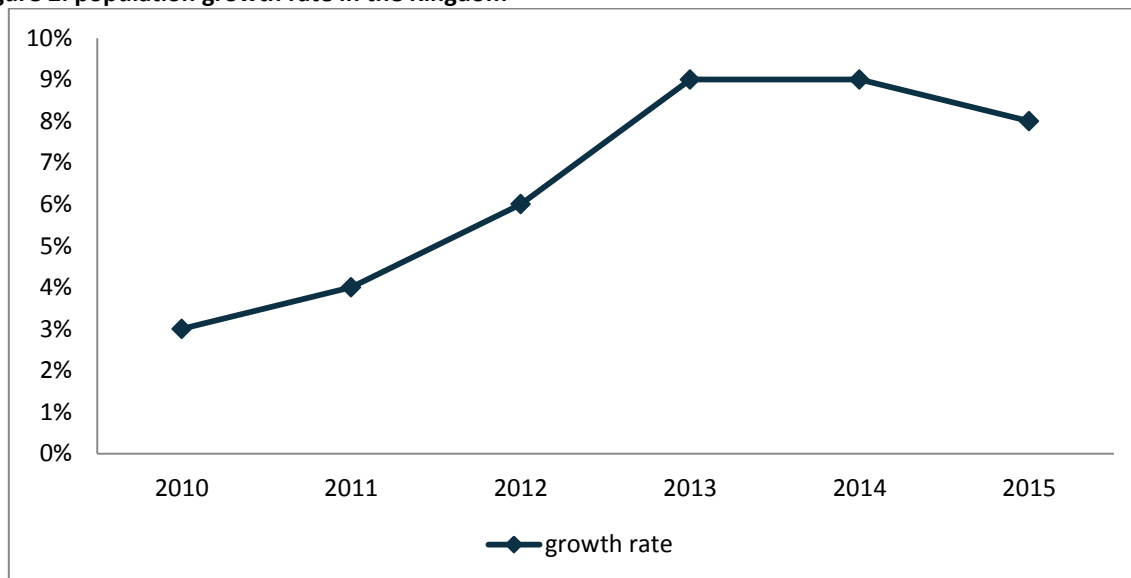
The unemployment rate among Jordanians also witnessed a rise by 1.1 percentage to reach to 13%, due to the structural imbalances that the labor market is suffering from and the acquisition of the low-paid foreign workers on a large number of new jobs in the economy, according to the Central Bank of Jordan.

**Table 3: Number of population and population growth in the Kingdom, thousand**

	2010	2011	2012	2013	2014	2015
population	6698.0	6993.0	7427.0	8114.0	8804.0	9531.7
growth rate	%3	%4	%6	%9	%9	%8

Source: Department of Statistics

**Figure 2: population growth rate in the Kingdom**





### **2.3 Economic Indicators in the Kingdom <sup>1</sup>**

Countries across the Middle East are still suffering from instability and closure or partial closure of borders; including the borders of important markets for the Kingdom's products. These factors led to a decline in the performance of many of the economic sectors, including the external sector, national exports, touristic income, and Foreign Direct Investment (FDI), and they contributed to a slowdown in the economic growth to about 2.4% in 2015, compared to 3.1% in 2014. The growth achieved in 2015 came from growth across several economic sectors, especially in the finance, insurance, and real estate services; the transport, storage, and communications services; the mining industry; the manufacturing industry; and the agriculture sector. These sectors contributed a combined 1.8 percentage points (or 75%) of the growth rate achieved during 2015, reflecting the diversity of the economic growth sources in the Kingdom.

Additionally, the general price level registered a decline in the prices of oil, commodities, and other related services in the global markets. Therefore, the general price level, measured by the relative change in the average consumer price index deflated by 0.9% in 2015, compared to the inflation of 2.9% in 2014.

The budget deficit, after aid, increased by 1.2% to a record 3.5% of GDP, compared with 2.3% in the previous year. In addition, the Balance of Payments' Current Account recorded a deficit of 8.9% of GDP, compared with 7.3% in 2014. At the end of 2015, the net public debt amounted to 22,847.5 million Jordanian Dinars (85.8% of the GDP), with an increase of 5.0% of the GDP. However, the total public debt reached 24,876.5 million Jordanian Dinars (93.4% of GDP). This increase resulted from financing both the general budget deficit and the guarantees for loans for the National Electricity Company and the Water Authority, as well as the slowdown of economic growth during 2015. The indebtedness of the National Electricity Company and the Water Authority recorded 6.7 billion Jordanian Dinars at the end of 2015.

On the monetary and banking front, most monetary indicators experienced positive development in performance in 2015, primarily in the Central Bank's foreign reserves, which maintained comfortable levels that amounted to about \$14.2 billion. The dollarisation rate decreased, which reflected positive demand for Jordanian Dinars in comparison to other major foreign currencies. With regards to the activities of licensed banks, the outstanding balance of credit increased by 9.5%, to reach 21,103.5 million Jordanian Dinars at the end of 2015. The total deposits registered with licensed banks increased by 7.7%, to reach 32,598.5 million Jordanian Dinars at the end of 2015. The increase in deposits came as a result of the high dinar deposits, which increased by 2,001.4 million Jordanian Dinars (8.3%), and higher foreign currency deposits, which increased by 336.1 million Jordanian Dinars (5.4%).

Furthermore, many of the external sector indicators registered a drop in performance in 2015 due to the deepening instability in the region and almost full closure of the borders with Iraq and Syria. However, the drop in oil prices in the global markets contributed to the decline in the Kingdom's imports bill for energy, as it dropped by 40.6%, which in turn contributed to a decline in total

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<sup>1</sup> The Central Bank of Jordan

imports and the trade deficit by 11.4% and 14.0%, respectively. Thus, the Current Account, excluding aid, declined to 11.9% of GDP, compared to 12.4% in 2014.

The Current Account deficit increased after aid, to reach 2,365.6 million Jordanian Dinars (8.9% of GDP) in 2015, compared with a deficit of 1,851.7 million Jordanian Dinars (7.3% of GDP) in 2014. This decline is due mainly to the decline in total exports by 6.6% and the decline in surplus in the services account by 27.7%, as touristic income decreased by 7.1%, and the decline in the surplus in the current transfers account decreased as a result of reduced foreign aid.

Capital and financial accounts resulted in a net inflow of 1,593.7 million Jordanian Dinars in 2015, compared to 909.0 million Jordanian Dinars in 2014; this was due to the Kingdom's higher net obligations towards the outside world. Foreign Direct Investment registered a net inflow of 909.4 million Jordanian Dinars, and the reserved investment registered an inflow of 918.4 million Jordanian Dinars due to the Kingdom issuing Eurobonds that are worth \$2.0 billion in the global markets. The withdrawal of bank loans on behalf of the Central Bank increased the use of funds from the International and Arab Monetary Funds by 543.3 million Jordanian Dinars. This led to the registration of a surplus in the overall Balance of Payments of 328.7 million Jordanian Dinars during 2015, compared to a surplus of 1,550.7 million Jordanian Dinars during 2014.

According to the Central Bank of Jordan, the increased international investment at the end of 2015 showed an increase in the external net liabilities of the Kingdom, which reached 24,357.5 million Jordanian Dinars, compared with 22,578.8 million Jordanian Dinars at the end of 2014. This was due to an increase in the external balance of assets and financial liabilities for all of the economic sectors in the Kingdom, which reached to 18,657.9 million Jordanian Dinars and 43,015.5 million Jordanian Dinars, respectively, during 2015.

**Table 4: main economic indicators 2011 to 2015 in millions of dinars**

	2011	2012	2013	2014	2015
<b>Population (millions)</b>	6.993	7.427	8.114	8.804	9.532
<b>Unemployment rate</b>	12.9	12.2	12.6	11.9	13.0
<b>Production and Prices</b>					
GNP at current market prices	20,288.8	21,690.0	23,611.2	25,141.2	26,289.6
GDP at current market prices	20,476.6	21,965.5	23,851.6	25,437.1	26,637.4
The rate of growth in GDP at constant market prices (%)	2.6	2.7	2.8	3.1	2.4
The total national disposable income at current prices	23,743.5	24,774.9	28,424.5	30,302.1	30,234.7
The rate of growth in gross national disposable income at current prices (%)	4.7	-0.2	8.6	3.1	-2.4
Change in the index of consumer prices (%)	4.2	4.5	4.8	2.9	-0.9
The change in the GDP deflator (%)	6.4	4.5	5.6	3.4	2.3
<b>Money and Banking</b>					
Exchange rate of the Jordanian dinar to the US dollar	1.410	1.410	1.410	1.410	1.410
Money supply (P2)	24,118.9	24,945.2	27,363.4	29,240.4	31,605.5
Net foreign assets of the banking system	9,370.1	6,665.5	6,923.4	7,932.3	8,137.3
Net domestic assets of the banking	14,748.8	18,279.7	20,440.0	21,308.1	23,468.2

	2011	2012	2013	2014	2015
system					
Net debt of the government	6,701.4	9,461.3	10,494.8	10,473.9	11,386.4
Private sector debts (Residents)	14,925.0	15,953.6	17,222.5	17,852.8	18,704.5
Other factors <sup>(1)</sup>	-6,877.6	-7,135.2	-7,277.3	-7,018.5	-6,622.7
Deposits in dinars at licensed banks	19,119.1	17,711.1	21,003.0	24,013.1	26,014.5
Foreign currency deposits at licensed banks	5,258.8	7,258.6	6,590.2	6,247.9	6,584.0
Rediscount rate (%)	4.50	5.00	4.50	4.25	3.75
Treasury bills interest rate for 6 months (%)	3.232	3.788	-	-	-
<b>Public Finance</b>					
Total revenue and foreign aid	5,413.9	5,054.2	5,758.9	7,267.6	6,796.4
Ratio to GDP (%)	26.4	23.0	24.1	28.6	25.5
Total spending	6,796	6,878.2	7,077.1	7,851.1	7,722.9
Ratio to GDP (%)	33.2	31.3	29.7	30.9	29.0
Overall deficit/savings (on an accrual basis)	-1,382.7	-1,824.0	-1,318.2	-583.5	-926.5
Ratio to GDP (%)	-6.8	-8.3	-5.5	-2.3	-3.5
Net outstanding balance of the domestic public debt	8,915.0	11,648.0	11,863.0	12,525.0	13,457.0
Ratio to GDP (%)	43.5	53.0	49.7	49.2	50.5
Outstanding external public debt <sup>(2)</sup>	4,486.8	4,932.4	7,234.5	8,030.1	9,390.5
Ratio to GDP (%)	21.9	22.5	30.3	31.6	35.3
<b>Foreign Trade and Balance of Payments</b>					
Current account	-2,098.8	-3,344.9	-2,487.7	-1,851.7	-2,365.6
Ratio to GDP (%)	-10.2	-15.2	-10.4	-7.3	-8.9
Trade balance (Deficit)	-6,261.7	-7,486.6	-8,270.1	-8,495.6	-7,249.3
Ratio to GDP (%)	-30.6	-34.1	-34.7	-33.4	-27.2
Commodity exports	5,684.5	5,599.5	5,617.9	5,953.6	5,558.3
Imports of goods (FOB) <sup>(3)</sup>	11,946.2	13,086.1	13,888.0	14,449.2	12,807.6
Balance of services (net)	896.0	1,332.3	1,209.5	1,778.9	1,286.4
Income account (net)	-187.8	-275.5	-240.4	-295.9	-347.8
Current transfers (net)	3,454.7	3,084.9	4,813.3	5,160.9	3,945.1
Capital and financial account (net)	2,298.9	3,808.9	1,811.1	908.9	1,593.7
Direct foreign investment in Jordan (net)	1,055.0	1,074.3	1,281.2	1,426.7	905.1

Source: Monthly Statistical Bulletin, Central Bank of Jordan

1. Includes the debts of public and financial institutions and other factors, as shown in the Monetary Survey Agenda.
2. This represents the total balance of drawn loans, minus total repayments.
3. Does not include imports of non-resident entities.

## 2.4 The Jordanian Investment Environment

### **Investment Law No. 30 for 2014**

Investment Law no. 30 for 2014 is considered an appropriate legislative framework to attract foreign investments and stimulate local investments. It is considered a competitor to other investment laws in the region because it contains many advantages, incentives, and guarantees, and it offers a range of incentives and benefits in and outside the Development and Free Zones. The law includes a series of public provisions, such as foreign investment guarantees (depositing and withdrawal of capital, investment management, and transfers) and the inadmissibility of the disbarment of investment property. The law offers provisions to settle investment disputes, protection, and encouragement of mutual investment agreements between the Kingdom and other countries.

The following shows the major incentives granted by the law:

#### **❖ Incentives and Benefits outside the Development and Free Zones**

- The production inputs for the industrial and crafts sectors are exempted from customs duties.
- The return of the general sales tax on the production inputs for the industrial and crafts sectors within 30 days.
- Production inputs and fixed assets of the industrial and crafts sectors are exempted from customs duties and are granted a reduction in general sales tax to 0%.
- Returning to the sales tax on the services needed to practice economic activity within 30 days.
- The goods that are necessary for the economic activities of the following sectors are exempted from customs duties and are subject to 0% general sales tax:
  - Agriculture and livestock, hospitals and specialised medical centres, hotels and touristic facilities, touristic entertainment and recreation centres, call centres, scientific research centres and laboratories, art and media production, convention centres and exhibitions, transfers and/or distributions and/or extraction of water, gas and oil derivatives, air transport, maritime transport, and railways.

#### **❖ Incentives and Benefits inside the Development and Free Zones**

- 5% income tax on the income generated from economic activity within the Development Zone.
- 5% income tax on income generated from economic activity in the industrial sector.
- Tax exemptions that are granted in the Kingdom on goods and services exports.
- Reduction of sales tax to 0% on goods and services that are used by the establishment in order to exercise its activity inside the Development Zone.
- 7% sales tax on specific services provided by a registered company in the zone when these services are consumed in the zone.
- Exemptions from customs duties except for a specified number of goods.

#### **❖ The Reduction of Income Tax in the Least Developed Areas for Regulation No. 44 for 2016**

- The reduction of income tax in the least developed areas for Regulation No. 44 for 2016 was approved. It aims to create an attractive environment for investments that promote economic development through the reduction of income tax outside the Development Zones and in the least developed areas in the Kingdom. The regulation specified the areas that are considered least developed and identified the activities that are excluded from this reduction.
- Under the provisions of Articles 4 and 5 of this regulation, the areas that were categorised as least developed and enjoy the reduction in income tax are divided into four categories; each category enjoys a reduction in income tax on their activities for a period of 20 years.
- Category A includes the Northern Valley District, Deir Alla District, Shouneh Al-Janoubieh District, the Southern Valley District, Rweished District, the Northern Desert District, the North Western Desert District, Al-Azraq Province, Al-Jiza District except for the borders of the new Al-Jiza municipality, Al-Moakar District except for the borders of Al-Moakar municipality, and the Governorate of Aqaba except for the Aqaba Special Economic Zone. The reduction rate for this category is 100%.
- Category B includes the Governorates of Maan, Tafileh, Karak, and Ajloun. The reduction rate for this category is 80%.
- Category C includes the Governorates of Jarash, Mafraq, and Irbid except the borders of the Greater Irbid Municipality. The reduction rate for this category is 60%.
- Category D includes the Governorates of Madaba, Balqa, Amman except for the Greater Amman Municipality, and Zarqa except for the borders of Zarqa Municipality and Russaifeh Municipality. The reduction rate for this category is 40%.

#### ❖ **Trade and Free Trade Agreements**

The most important agreements are:

- Jordan joining the World Trade Organisation in 2000, which led to the opening of the markets of 150 countries for Jordanian exports in goods and services, and provided new opportunities of access to other countries within a clear and transparent environment of laws, regulations, and procedures.
- A series of regional trade agreements, such as the Jordan Partnership Agreement with the European Union, Agadir Agreement, Free Trade Arab Agreement, the free trade agreement between Jordan and the European Free Trade Association, and the adoption of the Euro-Mediterranean simplification of the rules of the Origin System, which includes the decision to simplify the rules of the origins of Jordanian products between Jordan and the European Union came into effect on July 19, 2016, and will remain in effect until December 31, 2026.
- A series of bilateral trade agreements with many countries, such as the free trade agreement between Jordan and the United States of America, the Qualified Industrial Zones Agreement, the free trade agreement between Jordan and Singapore, the free trade agreement with Turkey, the free trade agreement with Canada, and many other agreements.
- Jordan has signed more than 35 agreements with Arab and foreign countries in order to prevent double taxation between Jordan and these countries, thus protecting investors' rights.
- The Agreement of Promotion and Protection of Investments and the Movement of Capital between the Arab Countries was signed in 2000 with 11 Arab countries who are members of the Arab Economic Unity Council, in order to establish an appropriate environment for

investments and economic cooperation between investors in the Arab countries, thus pushing and stimulating investment activities by providing encouragement and mutual protection for Arab investments.

#### **Human Development Report for 2015**

The Human Development Report that was issued by the United Nations Development Program in 2015 showed that Jordan fell 3 points to number 80. Please note that Jordan's place on the Human Development Report index value has improved slightly.

#### **Global Competitiveness Report**

The Kingdom's rank has improved by one point in the Global Competitiveness Report for the year 2016/2017, at 63 out of 138 countries compared to 64 out of 140 countries in the 2015/2016 report. It is considered an insignificant improvement, especially because of the reduction in the number of countries participating in this year's report. Amongst the Arab countries, Jordan was ranked after the United Arab Emirates, Qatar, the Kingdom of Saudi Arabia, Kuwait, and Bahrain, who were ranked 16, 18, 29, 34, and 39, respectively.

#### **Doing Business Report**

In the Doing Business Report that was issued by the World Bank Group, Jordan is still ranked 118, up one rank from the 2016 report, because of the variation in the performance of the different sub-indicators. Jordan ranked ninth among the Arab countries; the United Arab Emirates was ranked first among the Arab countries at 26, followed by Bahrain at 63 and Oman at 66.

## **2.5 The Economic Environment in the short and medium term**

Risks analysis implemented by BMI indicates that the Jordan's political and economic risks in the short and medium term are less than the overall average of the world and the Middle East. The state's risks and the operational risk are estimated to be within the acceptable levels. The international institutions' forecasts point out that the economic and foreign trade indicators are expected to achieve acceptable rates of growth with the exception of the continued increase in internal and external indebtedness.

**Table 5: Assessment of short and long-term risks**

	Long term		Short term		Operational risks	State risks
	political	Economic	political	economic		
Jordan	63.1	39.2	66.6	46.2	58.7	55.4
Turkey	60.2	49.4	58.4	56.9	55.9	56.1
Egypt	53.3	45	52.4	48.7	42.9	47.5
Lebanon	45.8	54	55.4	53.5	44.2	49.5
West Bank and Gaza	33.1	38.1	32.2	36.5	32.5	34.3
Syria	22.9	24.4	22.4	23.6	29.3	26.1
Regional average	49.4	46.9	51.2	48.7	46.6	48.3
global average	64.1	50.7	61.3	51.9	49.8	54.6

Source: the economy and state risks, IHS, 15/09/2016

**Table 6: The most important key economic indicators 2016-2020**

Indicator	2016	2017	2018	2019	2020
The growth rate of GDP	2.6	2.7	2.8	3.2	3.1
GDP (in USD billions)	39.6	42.1	44.8	47.8	50.9
Population (In millions)	9.8	10.1	10.4	10.7	11.0
Consumer Price Index (% change)	-0.7	1.8	3.3	4	3.2
Exports (in USD billions)	7.3	7.6	8.2	8.8	9.6
Imports (in USD billions)	18.3	19.2	20.1	21.3	22.8
Foreign direct investment, the net value (in USD billions)	1.5	1.5	1.6	1.6	1.7
Foreign direct investment, the net value (% of GDP)	3.7	3.7	3.6	3.4	3.3
Foreign exchange reserves (in USD billions)	13.9	14.9	15.7	16.8	17.7
Total external debt (in USD billions)	24.4	27.8	30.7	33.7	36
Total external debt (% of GDP)	61.6	66	68.6	70.4	70.6
Total external debt (% of foreign currency earnings)	127.3	138.3	143.6	147.5	147.8

Source: the economy and state risks, IHS, 15/09/2016

### **3. Market Study**

#### **3.1 Project Description**

The project is based on the establishment of a farm for the production of the cut flowers (Roses, Carnation, bulbs and annual flowers) in addition to the roses plant (propagation by cutting) and the isolated bulbs inside the protected houses through the application and use of the modern techniques in agriculture which in themselves reduce the costs of the project establishment and covers all stages from the process of planting and taking care of them by irrigation, fertilization, pruning and fighting the agricultural lesions till the the production of flowers and bulbs and marketing and selling them in the local market and exporting them to the external markets. The farm area will reach 35 dunums and will be located in Madaba in Theban region which is a shafa Ghor area suitable for planting of flowers and characterized by the availability of the wide plains and the fertile soil and water supply due to its proximity to Haidan Stream. Moreover, the revenues of planting cut flowers are considered of higher economic return than planting other agriculture crops.

It's worth mentioning that the cut flowers need much care for being crops that are subject to damage, so, it is necessary to apply and use modern techniques of agriculture via the planting by using solid environments such as the Volcanic Tuff (Pozzolana) because it contains natural substances necessary for the growing of the plant and reduces the consumption of insecticides fertilizers and water.

#### **3.2 Expected Products Description**

The expected products of the project include the following:

- Cut flowers (Roses, Carnation)
- Cut flowers bulbs (Gladiolus, Tulipa, Lilum, Lily, Black Iris, etc.)
- Annual flowers (Gypsophilia, Chrysanthemum, Aster, Matthiola, Snapdragon, etc.)
- Roses plant (propagation by cutting)
- Bulbs cultivated in flasks.

#### **3.3 The Agriculture Sector**

Madaba governorate is characterized by various topographies; such as wide plains and fertile soil in addition to the Ghor and shafa Ghor areas. 63% of the area of Madaba governorate is cultivated land by (The Agriculture Directorate). The agriculture in of Madaba varies among planting the field corps, vegetables, fruits and olives. Despite of these advantages that characterizes the governorate, the indicators of the agricultural and animal production of the governorate is low compared to the rest of the kingdom. As the area cultivated with the field crops are not more than 9% of the cultivated area in the kingdom, and don't exceed 2% from the area cultivated with the fruit trees. The cultivated area of Madaba governorate represents only 7% of the cultivated area in the kingdom and represents 18% from the total area of the governorate which indicates the weak exploitation of the agricultural sector and the agricultural investments in the governorate.



It's worth mentioning that the number of the agricultural cooperatives is one of the most significant indicators for the importance of the agriculture sector in Madaba governorate, as they have become 21 agricultural cooperative. The following table shows the most significant agriculture sector indicators in the governorate.

**Table 7: Agriculture sector Indicators in Madaba Governorate compared to the kingdom in 2015.**

Indicators of The Agriculture sector in Madaba Governorate	Madaba Governorate	The Kingdom	Governorate's Ratio
Area cultivated with the field crops (dunums)	60108	702400	9%
Area cultivated with fruit trees and citrus fruits (dunums)	9940	402900	2%
Area cultivated with vegetables (dunums)	18703	497500	4%
Area cultivated with olives (dunums)	69000	994600	7%
Total cultivated area (dunums)	172100	2597400	7%
Number of cooperatives	21	284	7%

Source: Agriculture directorate, Madaba 2015  
 Ministry of Agriculture, annual report 2015

**Table 8: Rates of rainfall during the period 2008-2014 in Madaba Governorate**

Period	2008/2009	2009/2010	2010/2011	2011/2012	2012/2013	2013/2014
Madaba	126.2	153.7	156.7	151.4	124.4	182.1

Source: Ministry of Agriculture, annual report 2014

### 3.4 Cut Flowers & Ornamental Plants Sector

Jordan is considered one of the most significant countries in the region in producing cut flowers and produces the best international types. There are many modern farms that uses modern technologies to produce different types of cut flowers. According to the Ministry of Agriculture estimates, the number of greenhouses planted with cut flowers reached 2500 in 2016, and the number of cut flowers farmers is about 70 farmers who plant several kinds of flowers such as Roses, Bird of paradise, Freesia, Carnation, Lily Orietal, Lilum and etc. It's worthy to say that cut flowers production reaches more than 70 million flowers and bulb from the different kinds annually.<sup>2</sup>

The following is the most important challenges that face the cut flowers and ornamental plants sector:

- The low Number of specialists in in the area of planting cut flowers.
- Water challenges.
- High cost of the initial investment.

<sup>1</sup>Estimation of the Ministry of Agriculture on 2016

## Flowers Auctions and Association

The kingdom has two auctions for cut flowers, one in Safout region and the other is in Amman , which is the first market in the middle east because it was opened in 1984 for the first time. This idea has been derived from the original idea of the cut flowers market in Netherlands and it was established by the cut flowers producers due to the increasing demand for this product.

The auction is working on attracting the owners of flower shops and the exporters, opens the discussion channels with the producers about their needs and requirements, provide the farmers with the consultation services by virtue of urging them to plant particular kinds of flowers, receives local flowers during the year by using the normal cultivating (uncovered) or the green houses and export flowers to Arabic and western countries (Lebanon, gulf countries, France, Germany, U.K and Netherlands). The market gets certain commission from the farmer/ producer for marketing and selling their products.

The Association of cut flowers and ornamental plants producers was established in 2005 aiming to organize the cut flowers sector in Jordan. The Ministry of Agriculture organizes a fair every year by virtue of cooperation with this association to exhibiting different products of cut flowers kinds and sells directly to customers.

### 3.5 Analysis of Market Size

In order to estimate the cut flowers market size, interview has been conducted with some experts in addition to field visits and contacts with the cut flower markets and the cut flowers producers association. It has been noticed that demand and interest towards cut flowers in Jordan has increased due to the changes in quality of life and the interest of people in the community in buying flowers repeatedly, which is evident in both Amman capital Governorate and Madaba Governorate.

Furthermore a study and analysis has been conducted of the different sources of information including the imports, exports and local production in the kingdom to have comprehensive data that would enable the estimation of the market size of cut flowers of different kinds in the kingdom. The analysis revealed that the market demand on the cut flowers is met by the local production and imports from other countries.

To estimate the market size of the cut flowers in the kingdom, following equation has been used:

$$\text{Market Size} = (\text{Total of the local production + total of imports}) - (\text{Exports + Re-Exports})$$

The following shows the details of this equation and the method of calculation:

#### 1. Local Production

The field market research that has been conducted showed that the local production of the cut flowers in the kingdom is produced by farms that exist in some governorates of the kingdom and especially Al-Balqa and Madaba. The number of farmers and companies that plant different kinds of cut flowers is estimated at about 60-70 farmer/ company<sup>3</sup>. The local cut flowers products are marketed via two methods:

- Direct sale: farmer /company sells his /its products of the cut flowers directly to the customers or flowers shops or in his /its own exhibition. The farmer / the company can export his / its products directly.
- Cut Flower markets: farmers /companies exhibit and sell their products through the markets, as well it is possible to export produced cut flowers via these markets.

It has been noticed by the field visits and experts meetings that Amman cut flowers market constitutes 90% of the volume of the sales of the Jordanian markets of cut flowers, while Safout market constitutes 10% of the sales volume in these markets.

To calculate the quantity of the local production of flowers, it is necessary to take into consideration the following assumptions that have been obtained by the field study, the meetings with the experts of the sector and meeting with the cut flowers markets:

- 50% of the farmers /companies of cut flowers products are sold through direct sale.
- 50% of the farmers /companies of cut flowers products are sold through the cut flowers markets.
- Amman cut flowers market constitutes 90% of the cut flowers markets sales and Safout market constitutes 10%.
- 30% of the volume of the local production is exported.

The following table shows Amman cut flowers market sales in 2016:

**Table 9: Jordan flower Auction (Amman) sales in 2016**

Type	Sales quantity (Number)	Value (JD)
Flowers	20,594,286	3,253,325
Greenery	4,111,657	170,614
<b>Total</b>	<b>24,705,943</b>	<b>3,423,939</b>

Source: Jordan Flower Auction-Amman, 2016

**Table 10: cut flowers Auctions sales in the Kingdom for 2016**

Type	Sales quantity (Number)
Sales of Amman cut Flowers market	24,705,943

<sup>2</sup> According to the field study and the Jordan Flower Auction (Amman)

Type	Sales quantity (Number)
Sales of Safout cut Flowers market	2,470,594
Markets sales	27,176,537

Source: Jordan Flower Auction-Amman, 2016/ Estimations of the Study team.

According to the above assumptions and the sales numbers of the Amman Auction, the volume of local production of flowers can be estimated at 54,353,075 flowers according to the following equation:

$$\begin{array}{l}
 \text{The volume of local production} = \text{Sales of Auctions} + \text{Direct sales} \\
 \text{The volume of local production} = (\text{Amman Auction sales} + \text{safout Auction sales}) + \text{Direct sales} \\
 \text{The volume of local production} = (24,705,943 + 2,470,594) + 27,176,537 \\
 \text{The volume of local production} = 54,353,075 \text{ flowers}
 \end{array}$$

According to the volume of the local production and the previous assumptions, the export volume of the cut flowers can be estimated at 16,305,922 flowers, which is equivalent to 30% of the local production.

## 2. Import

The imports of cut flowers during 2016 is estimated at 138,146 kg. According to the Jordan Auction Flower (Amman) data which estimate an average of 25 flowers per 1 kg<sup>4</sup>, the imports are estimated at 3,453,650 flowers. The following table shows the breakdown of imports by type.

**Table 11: Imports of Flower for the year 2016**

Type	quantity (kg)	Quantity (Number)*	Value (JD)
Orchid imports	33,393	834825	110,280
Imports of the rest of cut flowers types	42,541	1063525	275,199
Imported by the stem of Flowers	62,212	1555300	176,282

<sup>1</sup>This number was estimated based on expert opinions and flower Auction data

Type	quantity (kg)	Quantity (Number)*	Value (JD)
<b>Total</b>	<b>138,146</b>	<b>3,453,650</b>	<b>561,761</b>

Source: Jordan Flower Auction-Amman -Amman, 2016

\* Assuming that each 1 kg is equivalent to 25 flowers

In return to the original equation to calculate the market size stated in the beginning of this part of the study, the results are as follows:

Total Market Size	=	Total Domestic Production + Total Imports	-	(Export + Re-export*)
Total Market Size	=	(54,353,075 + 3,453,650)	-	(16,305,922 + 0)
Total Market Size	=	57,806,725	-	16,305,922
Total Market Size	=	41,500,802 flowers		

\* According to Department of statistics data, as the cut flowers are not re-exported

## An Overview of Competitors

There are many local farmers/companies that grow and produce cut flowers in the Kingdom, the following is an overview of the project important competitors to the project.

**Table 12: The main competitors of the project in the production of cut flowers and ornamental plants**

Competitor / Farm	Area by Dunum	Products	Location
Alissar Farm, has two farms	21 +30	(Eustoma, Lilum, Roses,....etc)	Abu Nusair, Alghor
Al-Nimr Farm for Flowers	30	(Roses, Solidago, Lilum)	Madaba
Fakhoury Farm	20	(Roses, Matthiola, Lilum)	Madaba
Omar Younis Farms	25	(Roses, Matthiola, Gerbera, Eustoma, Chrysanthemum)	Madaba
Ihab Maayaa Farms	25	Eustoma	Madaba
Nader Raymon Farms	20	(Roses, Aster, Chrysanthemum, Eustoma, Gerbera)	Madaba

Source: Field studies and interviews by the Study team.

### 3.6 Price Analysis

The price of project products from cut flowers depends on the following:

- Harvesting time / season
- Leg length
- Flower color
- Quality and type
- Floral quality and scarcity
- Occasional or urgent occasions (such as Valentine's Day, Mother's Day, Weddings etc)

Consequently, it is worth mentioning that most of the auction sales are from Jury roses, while most imports are from bulbs. The following is the average price of cut flowers and greenery in the Jordan flower Auction (Amman).

**Table 13: Average Sale price per flower in Jordan flower auction (Amman).**

Type	Average Sale price/Flower (JD)
Flowers	0.16
Greenery	0.04
Total	0.14

The following table shows the Sale prices of some types of flowers and Annuals in the local market (the lowest price - the highest price).

**Table 14: Average sale price per a flower in the local market**

Cut Flowers/Type	Average sale price/Flower (JD)
Jory Roses (flower)	0.15 – 0.40
Carnation (flower)	0.15 – 0.20
Lilum (bulbs)	0.3
Iris (bulbs)	0.20 – 0.40
Gerbera (flower)	0.10 – 0.25
Annals	0.05 – 0.12

### 3.7 Marketing Strategy

#### Target Market

The project targets the following categories:

- The Jordanian market in all governorates
- Export markets

#### Expected Prices

The following table shows the average prices which the project will sell its products in both the local markets and export.

**Table 15: Average prices of project products**

Category	Price (JD/Flower)
Flowers (Roses, Carnation)	0.16
bulbs flowers	0.26
Annuals	0.04
Roses plant (propagation by cutting)	0.6
bulbs cultivated in flasks	0.45

#### Expected services and products

Expected project services include the production and sale of the following products in the local market and export:

- Cut flowers (Roses and Carnation)
- Cut flowers bulbs (Gladiolus, Tulipa, Lilum, Lily, Black Iris, etc.)
- Annual flowers (Gypsophilia, Chrysanthemum, Aster, Matthiola, Snapdragon, etc.)
- Roses plant (propagation by cutting)
- bulbs cultivated in flasks

#### Promotion

The project's promotional strategy includes:

- Direct marketing to major consumers such as flower sale shops, restaurants, hotels, through agreements with targeted customers
- Designing an attractive website and using social media
- Filming videos that describe the production process, quality of products and its distinguished characteristics from those in the market and using it for promotion on the website
- Participation in local and international exhibitions of the most important products of the project, especially the Dutch market
- Direct sale in the local market and flower auction.
- It is proposed in the future to open one or more flower shops to market the project's products in the local market



- Concluding cooperation agreements with Jordanian universities aimed to improve the product quality and training of students.
- Concluding twinning and partnership agreements with major producers in the Netherlands and Europe to produce for them, as well as accessing to their (know-how), with preserving property rights and their marketing plans.

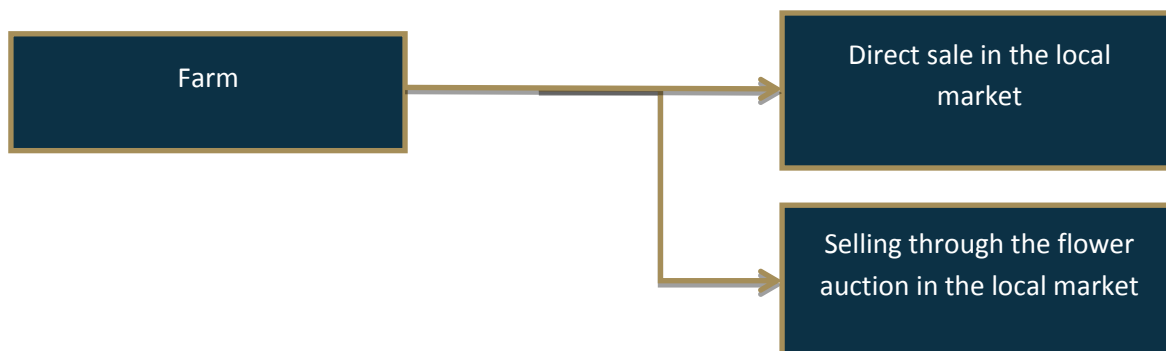
## **Selling**

The sales strategy of the project is as follows:

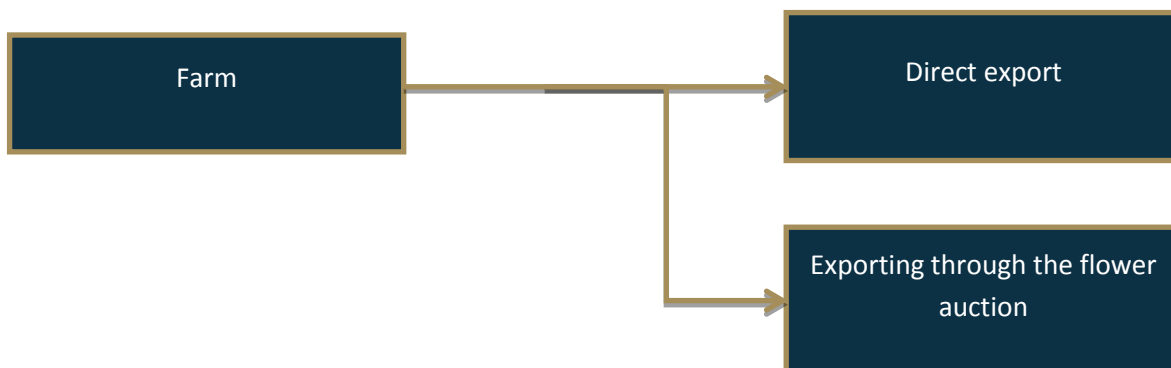
- Direct sale to wholesalers and retailers through the flower auction and through personal relationships
- Sale to foreign markets (export) through the Jordanian flower auction and international flower auction as well as personal relationships

The following figure shows the sales strategy of the project:

### **A. Selling in the local market**



### **B. Selling to export markets:**



## **3.8 The Expected Market Share**

- It is expected that of the proposed project will begin operation in 2019.

- The growth rate of the cut flowers market was estimated at 7% annually considering from 2016 to 2019, therefore the expected market size becomes as follows:

Item	2016	2017	2018	2019
Market size (Flowers number)	41,500,802	44,405,858.4	947,514,26	50,840,267

- Assuming continuation of the same growth of the cut flowers market size at a rate of (7%) during the project life time.

The following table shows the expected market share of the project in the first tenth years of operation of (Roses and Carnation) bulbs and annuals.

**Table 16: the market share of the project of cut**

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Production quantity (Number) thousand	1,778	2,142	2,538	2,538	2,538	2,538	2,538	2,538	2,538	2,538
Market Size (Number) thousand	50,840	54,399	58,207	62,282	66,641	71,306	76,298	81,638	87,353	93,468
Market share (%)	%3.50	%3.94	%4.36	%4.08	%3.81	%3.56	%3.33	%3.11	%2.91	%2.72

## 4. Technical Study

### 4.1 The Designed Project Capacity

As mentioned earlier, the project depends on farming without soil by using the following techniques:

- Farming by using medium (pozzolana).

This method has certain requirements and equipment's (for further details refer to Annex 1).

The following table shows the requirements for the farm from the land and the designed capacity of the project, where the land area is 35 dunums.

The following table shows the required area of the project, and for reaching the designed capacity, it is required to purchase a plot of land with an area of 35,000 m<sup>2</sup> and contains a well or to be near a water source, in addition, constructing buildings, warehouses and requirements for farming.

**Table 17: The designed capacity of the project:**

Cultivation Method	Area (dunum)	Agricultural product
Pozzolana	10	▪ Cut flowers (Roses and Carnation)
	10	▪ Cut flowers bulbs.
	1	▪ Annuals
	1	▪ Roses plant (propagation by cutting). ▪ Bulbs cultivated in flasks.

### 4.2 Production Process

The following figure shows the production process for the cut flowers production process. Which begins by preparing the greenhouses in addition to the preparation of the ground with pozzolana then farming roses plant and bulbs in addition to, providing all required services for plants such as irrigating, fertilizing, pruning and weeding....etc., and then picking flowers packaging, and storage them and making them ready for marketing, transporting and selling.



#### 4.3 The Required Fixed Assets

The following table shows the required fixed assets of the project.

**Table 18: Required Fixed Assets of the project**

Item	Unit	Unit price	Cost (JD)
The land (dunum)	35	10,000	350,000
Construction work	-	-	378,036
Machinery and equipment	-	-	288,000
Transportation vehicles	3	25,000	75,000
IT	1	-	10,000
Furniture and Fixtures	-	-	10,000
Others	-	-	15,000
<b>Total</b>			<b>1,126,036</b>

\*Numbers were estimated from market study.

#### 4.4 The Required Human Resources

The following table shows the required human resources for the project. The number of required employees is 29 employees with total salaries reaches 129,600 JD annually.

**Table 19: Required Human Resources for the Project**

Item	Number of Employees	Monthly Salary (JD)	Total Annual Salary (JD)	Operational Salary Annual (JD)	Administrative Salary Annual (JD)
General manager	1	1200	14,400	14,400	0
Technical manager( farm manger/ engineer)	1	800	9,600	9,600	0
Administrative employee	1	400	4,800	0	4,800
Driver	2	350	8,400	0	8,400
Security & General Safety Officer	1	350	4,200	4,200	0
Accountant	1	400	4,800	0	4,800
Warehouses and procurement employee	1	350	4,200	0	4,200
Maintenance technician	1	400	4,800	4,800	0
Marketing employee	2	400	9,600	0	9,600
Worker	18	300	64,800	64,800	0
<b>Total</b>	<b>29</b>	<b>4,950</b>	<b>129,600</b>	<b>97,800</b>	<b>31,800</b>

It is worth mentioning that there is a number of activities require seasonal labors which are subcontracted for doing these activities upon request such as plowing, picking flowers, besides their

collecting, grading, packaging, transporting, and distributing. The following table shows general job description of the most important required jobs of the project.

**Table 20: General Job description of the jobs required in the project**

Job	Job description
Technical manager (Agricultural engineer)	<p>Following farming work according to farm manager instructions and supervising workers.</p> <p>Making daily and monthly plans for achieving the annual plan which is prepared by the manage.</p> <p>Training workers on any new jobs.</p>
Administrative employee	<p>The administrative employee performs the following tasks:</p> <ul style="list-style-type: none"> <li>▪ Following up, preparing, reviewing, adjusting, documenting the organization management system includes procedures, rules, instructions, organizational and functional structures, tasks , specializations, job description cards and authorities matrix.</li> <li>▪ Preparing the estimated budget including salaries, allowances, operating charges, operation and maintenance programs, projects under accomplishment and new projects.</li> <li>▪ Follow up accounts and entries, producing budgets and financial statements.</li> <li>▪ Following employees, reviewing and issuing payrolls.</li> </ul>
Marketing employee	<p>Putting marketing policies, following various selling processes and directing marketing activities, in addition to following national markets and prices related to exporting, also following what reaches to the kingdom of competitive imports, making plans and alternatives for facing imports as well as plans for facing national competitors.</p>
Labor	<p>Caring for plants categories besides, fertilizing them , keeping conditions related to their growth, caring for them, carrying out procedures of protecting from diseases and plant epidemics which affect plants, spraying infected parts with pesticides and suitable plant medicines besides, treating them. Also, following plowing work, picking flowers, grading, packaging and other activities which are sub-contracted seasonally.</p>
Sub-Contracted Activities	<ul style="list-style-type: none"> <li>▪ Plowing.</li> <li>▪ Picking flowers and collecting.</li> <li>▪ Packing and packaging.</li> <li>▪ Transportation &amp; distribution.</li> </ul>

#### 4.5 The Required Licenses

The following table shows the necessary licenses from different parties to implement the project.

**Table 21: The licenses required for the project**

Statement	Analysis
Farm Registration	<ul style="list-style-type: none"> <li>▪ Ministry of Industry and Trade</li> <li>▪ Ministry of Agriculture</li> </ul>
Farm establishment	<ul style="list-style-type: none"> <li>▪ The concerned municipality</li> </ul>
Exploitation of the water of the Haidan Stream and allowing to pump with saltwater refinement	<ul style="list-style-type: none"> <li>▪ Water Authority</li> </ul>

#### 4.6 Project Timetable

The following figure shows the project implementation timeline of 12 months, noting that the start of flower production will be in the second year after establishment, as follows:

Phase	The First Year by months												The Second Year	
	1	2	3	4	5	6	7	8	9	10	11	12		
Studies														
Purchase and registration of land														
Preparation of land and cultivation														
Employment and commissioning														
Start of production														
Total duration required for implementation	12 months													

## 5. Financial Study

### 5.1 Financial Assumptions

The following table illustrates the financial assumptions of the project.

**Table 22: The Financial Assumptions of the Project**

Item	Assumption
Inflation Rate	3%
Financing Structure	Equity constitutes 75% of the investment and loans constitute 25%
Interest Rate	9%
Cost of Products (plant, seeds, fertilizing..., etc)	30% of total revenues
Costs of Water	1.5 JD/ 1 m
Costs of Electricity ,Fuel	2% of total revenues
Spare Parts and Maintenance Cost	1% of total investment, the Plastics will be replaced in greenhouses in the sixth year, as reflected in the financial model
Working Capital	6 months of annual cost
Pre-Operating Expenses	2% of total investment
Tax Rate	0%
Exemptions	Tax exemptions on the project (income tax and other taxes)
Assets Depreciation Rate	4%-20% of the asset value
Annual Salaries Increase	7%
Staff Benefits	35% of salaries
Accounts Receivable	2 months

### 5.2 Investment Cost



The project's Investment cost is estimated at JD 1.398 million distributed among fixed assets of JD 1.1 million, working capital and pre-operating expenses of JD 264 thousand, the following table shows the project's Investment cost.

**Table 23: the project's investment cost**

Item	Value (in thousand JD)
Fixed assets	1,126
Pre-operating expenses	27.9
Working capital	236
<b>Total</b>	<b>1,398</b>

### 5.3 Financing

The project will be financed with the shareholders by 75% which is estimated at about JD 1 million, while the other 25% of the project investment cost will be financed through bank loans of about JD 347 thousand.

The following table shows the financing structure for financing the project, where:

- The interest rate is 9%.
- The loan will be paid during 5 years.

**Table 24: Project financing schedule**

Item	Value (in thousand JD)	%
Equity	1,042.2	75%
Loan	347.4	25%
<b>Total</b>	<b>1,398</b>	<b>100%</b>

### 5.4 Revenues

The following table shows the total revenues of the project, where it is noted that the revenues in the first year amounts to about JD 462 thousand, and increased to reach up to JD 1.7 million in the tenth year.

**Table 25: The Expected Revenues**

Statement	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
<b>Revenues- Cut Flowers (Roses, Carnation)</b>										
Designed Capacity (Flowers)	1,500,000									
% of production ready to sales	60	80	98	98	98	98	98	98	98	98
Production quantity salable (Flowers)	900,000	1,200,000	1,470,000	1,470,000	1,470,000	1,470,000	1,470,000	1,470,000	1,470,000	1,470,000
Average prices	0.16	0.16	0.17	0.17	0.18	0.19	0.19	0.20	0.20	0.21
Revenues	144,000	197,760	249,524	257,009	264,720	272,661	280,841	289,266	297,944	306,883
<b>Revenues- Sales of Cut Flowers bulbs</b>										
Designed Capacity (Flowers)	1,200,000									
% of production ready to sales	70	80	98	98	98	98	98	98	98	98
Production quantity (Flowers)	840,000	960,000	1,176,000	1,176,000	1,176,000	1,176,000	1,176,000	1,176,000	1,176,000	1,176,000
Average prices	0.26	0.27	0.28	0.28	0.29	0.30	0.31	0.32	0.33	0.34
Revenues	218,400	257,088	324,381	334,112	344,136	354,460	365,093	376,046	387,328	398,947
<b>Revenues – sales of Annuals</b>										
Designed Capacity (Flowers)	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
% of production ready to sales	80	90	98	98	98	98	98	98	98	98

**Pre-Feasibility Study**  
**Establishment a Cut Flowers Farm**  
**Madaba**

Statement	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Production quantity (Flowers)	800,000	900,000	980,000	980,000	980,000	980,000	980,000	980,000	980,000	980,000
Average prices	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05
Revenues	32,000	37,080	41,587	42,835	44,120	45,444	46,807	48,211	49,657	51,147
Statement	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
<b>Revenues – sales of Roses plant (propagation by cutting)</b>										
Designed Capacity (Roses Plant)	-	900,000	1,200,000	1,470,000	1,470,000	1,470,000	1,470,000	1,470,000	1,470,000	1,470,000
% of production ready to sales	20	30	35	40	50	60	60	60	60	60
Production quantity (Roses plant)	0	270,000	420,000	588,000	735,000	882,000	882,000	882,000	882,000	882,000
Average prices	0.60	0.62	0.64	0.66	0.68	0.70	0.72	0.74	0.76	0.78
Revenues	-	166,860	267,347	385,514	496,349	613,488	631,892	650,849	670,375	690,486
Statement	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
<b>Revenues – sales of cultivated bulbs in flask</b>										
Designed Capacity (Bulbs)	1,000,000		-	-	-	-	-	-	-	-
% of production ready to sales	15	20	30	40	50	50	50	50	50	50
Production quantity (Bulbs in flask)	150,000	200,000	300,000	400,000	500,000	500,000	500,000	500,000	500,000	500,000

**Pre-Feasibility Study**  
**Establishment a Cut Flowers Farm**  
**Madaba**

Statement	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Average prices	0.45	0.46	0.48	0.49	0.51	0.52	0.54	0.55	0.57	0.59
Revenues	67,500	92,700	143,222	196,691	253,239	260,837	268,662	276,722	285,023	293,574
Statement	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
<b>Total Revenues</b>										
<b>Revenues- Cut Flowers (Roses, Carnation)</b>	144,000	197,760	249,524	257,009	264,720	272,661	280,841	289,266	297,944	306,883
<b>Revenues- Sales of Cut Flowers bulbs</b>	218,400	257,088	324,381	334,112	344,136	354,460	365,093	376,046	387,328	398,947
<b>Revenues – sales of Annuals</b>	32,000	37,080	41,587	42,835	44,120	45,444	46,807	48,211	49,657	51,147
<b>Revenues – sales of cultivated bulbs in flask</b>	67,500	92,700	143,222	196,691	253,239	260,837	268,662	276,722	285,023	293,574
<b>Revenues – sales of Roses plant (propagation by cutting)</b>	-	166,860	267,347	385,514	496,349	613,488	631,892	650,849	670,375	690,486
<b>Total Revenues – Thousand JD</b>	<b>462</b>	<b>751</b>	<b>1,026</b>	<b>1,216</b>	<b>1,403</b>	<b>1,547</b>	<b>1,593</b>	<b>1,641</b>	<b>1,690</b>	<b>1,741</b>

## 5.5 The Projected Costs

### Operating Costs

The following table shows the project's operating costs according to the previous assumption over ten years. Salaries cost in Year 1 amounted to JD 98 thousand which increase to reach JD 180 thousand in Year 10.

**Table 26: Operating Costs**

Operating Costs (in thousand JD)										
Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Salaries	98	105	112	120	128	137	147	157	168	180
Staff Benefits	34	37	39	42	45	48	51	55	59	63
Cost of Products (plant, seeds, fertilizing..., etc)	139	225	308	365	421	464	478	492	507	522
Water	60	62	64	66	68	70	72	74	76	78
Electricity, Fuel	11	11	12	12	12	13	13	14	14	14
Depreciation	58	58	58	58	58	58	58	58	58	58
Spare Parts and Maintenance	11	12	13	14	15	17	18	19	21	22
Others	10	11	11	12	13	14	15	16	17	18
<b>Total</b>	<b>421</b>	<b>521</b>	<b>617</b>	<b>689</b>	<b>760</b>	<b>821</b>	<b>852</b>	<b>886</b>	<b>920</b>	<b>957</b>

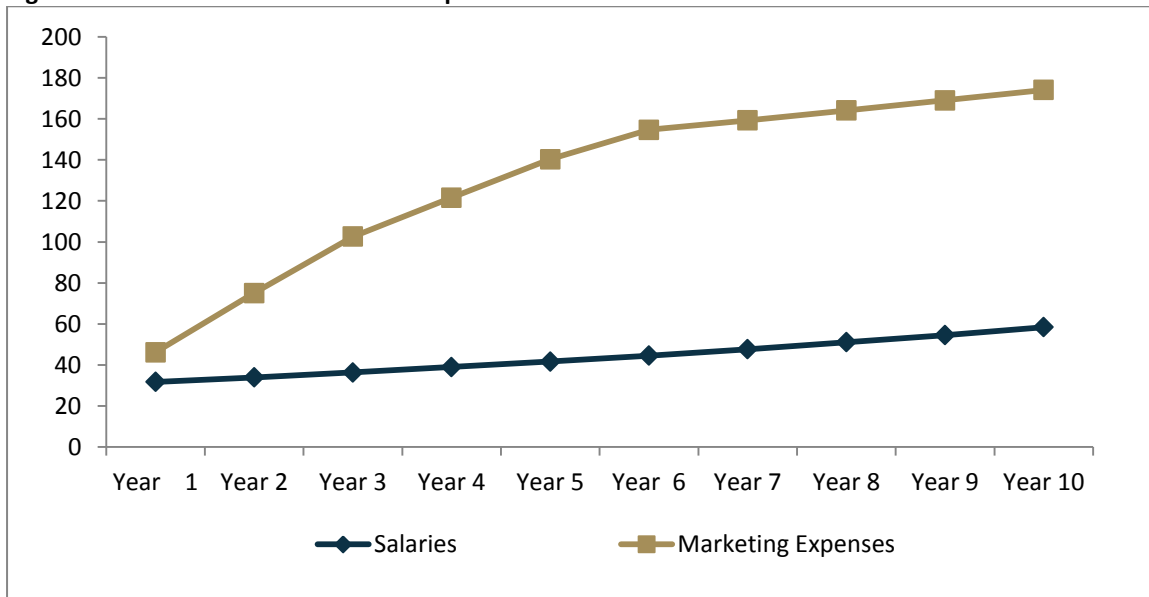
### Administrative Expenses

The following table shows the projected administrative expenses of the project. Employees' salaries reach JD 31.8 thousand in the first year and increase to JD 58.5 thousand in the tenth year. The marketing expenses are about JD 46 thousand in the first year and increase to reach JD 174 thousand in the tenth year.

**Table 27: General and Administrative Expenses**

General and Administrative Expenses (in thousand JD)										
Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Salaries	31.8	34.0	36.4	39.0	41.7	44.6	47.7	51.1	54.6	58.5
Staff Benefits	11.1	8.5	9.1	9.7	10.4	11.2	11.9	12.8	13.7	14.6
Staff Incentives	0.5	0.8	1.0	1.2	1.4	1.5	1.6	1.6	1.7	1.7
Stationery	5.0	5.3	5.5	5.8	6.1	6.4	6.7	7.0	7.4	7.8
Professional Fees	4.0	4.2	4.4	4.6	4.9	5.1	5.4	5.6	5.9	6.2
Marketing Expenses	46.2	75.1	102.6	121.6	140.3	154.7	159.3	164.1	169.0	174.1
Other Expenses	10.0	10.5	11.0	11.6	12.2	12.8	13.4	14.1	14.8	15.5
<b>Total</b>	<b>108.6</b>	<b>138.4</b>	<b>170.1</b>	<b>193.5</b>	<b>216.9</b>	<b>236.2</b>	<b>246.0</b>	<b>256.3</b>	<b>267.1</b>	<b>278.4</b>

**Figure 3: General and Administrative Expenses**



## 5.6 Projected Financial Statements

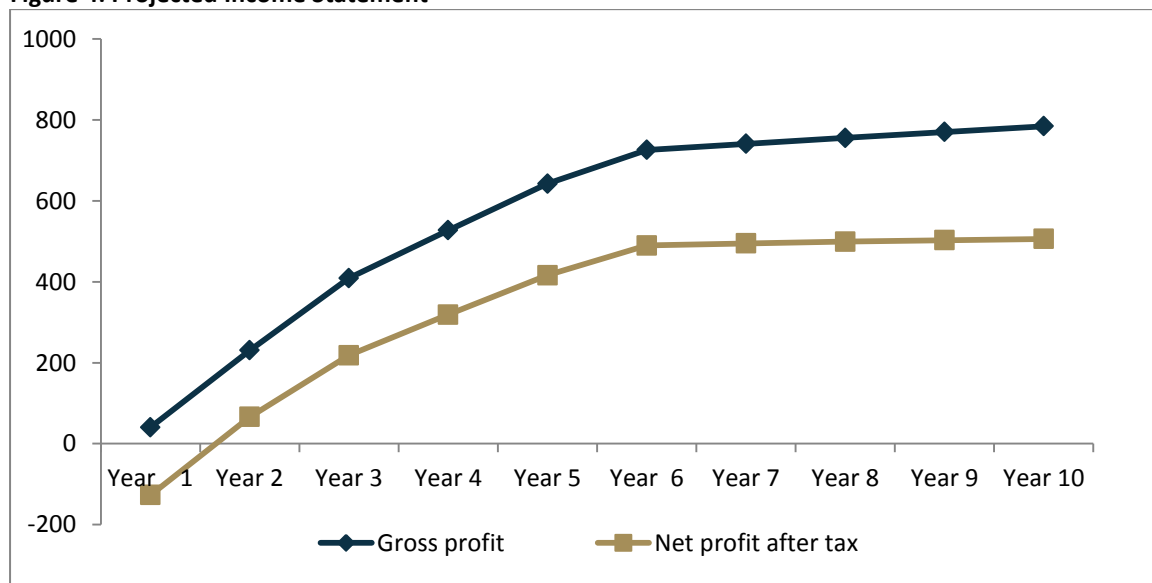
### Income Statement

The following table shows the projected income statement of the project. It indicates that gross profit will increase from JD 40.6 thousand in the first year to JD 784 thousand in the tenth year. It is worth mentioning here, that the net profit before tax is the same as after tax; because there are no taxes imposed on such projects.

**Table 28: The Projected Income Statement**

Income Statement (in thousand JD)										
Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Revenues	461.9	751.5	1,026.1	1,216.2	1,402.6	1,546.9	1,593.3	1,641.1	1,690.3	1,741.0
Operating costs (cost of sales)	421.3	521.0	617.1	688.6	760.0	821.0	852.5	885.6	920.3	956.7
Gross profit	40.6	230.5	409.0	527.5	642.5	725.9	740.8	755.5	770.0	784.3
Administrative expenses	108.6	138.4	170.1	193.5	216.9	236.2	246.0	256.3	267.1	278.4
Net profit	(68.0)	92.1	238.9	334.0	425.7	489.7	494.8	499.2	502.9	505.9
financial expenses	31.3	25.9	20.5	15.1	9.7			-	-	-
إطفاء مصاريف ما قبل التشغيل	27.8									
Net profit before tax	(127.0)	66.2	218.4	318.9	416.0	489.7	494.8	499.2	502.9	505.9
Tax	-	-	-	-	-	-	-	-	-	-
Net profit after tax	(127.0)	66.2	218.4	318.9	416.0	489.7	494.8	499.2	502.9	505.9

**Figure 4: Projected Income Statement**



### Projected Balance Sheet

The following table shows the projected balance sheet of the project during the first ten years. It indicates that total assets will increase from JD 1.3 million in the year of incorporation to about JD 2.1 million in the tenth year. The Total liabilities will decrease from JD 322 thousand in the first year to about JD 80 thousand in the tenth year. The Shareholders' Equity will increase from JD 1 million in the year of incorporation to about JD 2 million in the tenth year.

**Table 29: Projected Balance Sheet**

Balance Sheet (in thousand JD)											
Statement	Year of incorporation	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
<b>Assets</b>											
Cash	236	67	15	12	58	100	221	414	607	802	996
Receivables		77	125	171	203	234	258	266	274	282	290
Inventory		105	130	154	172	190	205	213	221	230	239
Other	-	9	15	21	24	28	31	32	33	34	35
Total Current Assets	236	259	286	357	458	552	715	924	1,135	1,347	1,561
Fixed Assets	1,126	1,126	1,126	1,126	1,126	1,161	1,161	1,161	1,161	1,161	1,161
Cumulative Depreciation	-	58	117	175	234	292	351	409	467	526	584
Pre- Operating Expenses	28										
Net Fixed Assets	1,154	1,068	1,009	951	892	869	811	752	694	635	577
Total Assets	1,390	1,327	1,295	1,308	1,350	1,421	1,525	1,676	1,829	1,983	2,137
<b>Shareholders Equity and Liabilities</b>											
Accrued Expenses and Payables		35	43	51	57	63	68	71	74	77	80
Long Term Loans	347	287	227	167	107	47	-	-	-	-	-
Total Liabilities		322	271	219	165	111	68	71	74	77	80
Shareholders Contributions	1,042	1,042	1,042	1,042	1,042	1,042	1,042	1,042	1,042	1,042	1,042
Retained Earnings		(38)	(18)	47	143	268	415	563	713	864	1,016
Shareholders' Equity	1,042	1,004	1,024	1,089	1,185	1,310	1,457	1,605	1,755	1,906	2,058
Shareholders Equity and Liabilities	1,390	1,327	1,295	1,308	1,350	1,421	1,525	1,676	1,829	1,983	2,137

### Cash Flow Statement



The following table shows the projected cash flow statement of the project during the first ten years. It indicates that there is a loss of cash flow from operation JD 197 thousand in the first year and will then fade to JD 549 thousand in the tenth year; while the Cash at the ending period will increase from JD 236 thousand in the year of incorporation to JD 966 thousand in the tenth year.

**Table 30: The Expected Cash Flows Statement**

Cash Flow Statement (in thousand JD)											
Statement	Year of incorporation	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
<b>Operation Activities</b>											
Net Profit	-	(127)	66	218	319	416	490	495	499	503	506
Depreciation	-	86	58	58	58	58	58	58	58	58	58
Change In Working Capital	-	(156)	(71)	(67)	(47)	(47)	(37)	(14)	(14)	(15)	(16)
Cash Flow From Operation	-	(197)	54	210	330	428	511	539	543	546	549
<b>Investing Activities</b>											
Fixed Assets	(1,154)	-	-	-	-	(35)	-	-	-	-	-
Cash From Investing Activities	(1,154)	-	-	-	-	(35)	-	-	-	-	-
<b>Financing Activities</b>											
Capital (Equity)	1,042	-									
Loan	347	(60)	(60)	(60)	(60)	(60)	(47)	-	-	-	-
Dividends		89	(46)	(153)	(223)	(291)	(343)	(346)	(349)	(352)	(354)
Cash Flow From Financing Activities	1,390	29	(106)	(213)	(283)	(351)	(390)	(346)	(349)	(352)	(354)
Net Cash Flow	236	(168)	(52)	(3)	47	42	121	193	194	194	195
Cash At The Beginning Period	0	236	67	15	12	58	100	221	414	607	802
Cash At The Ending Period	236	67	15	12	58	100	221	414	607	802	996

## 5.7 Financial, Economic and Social Analysis

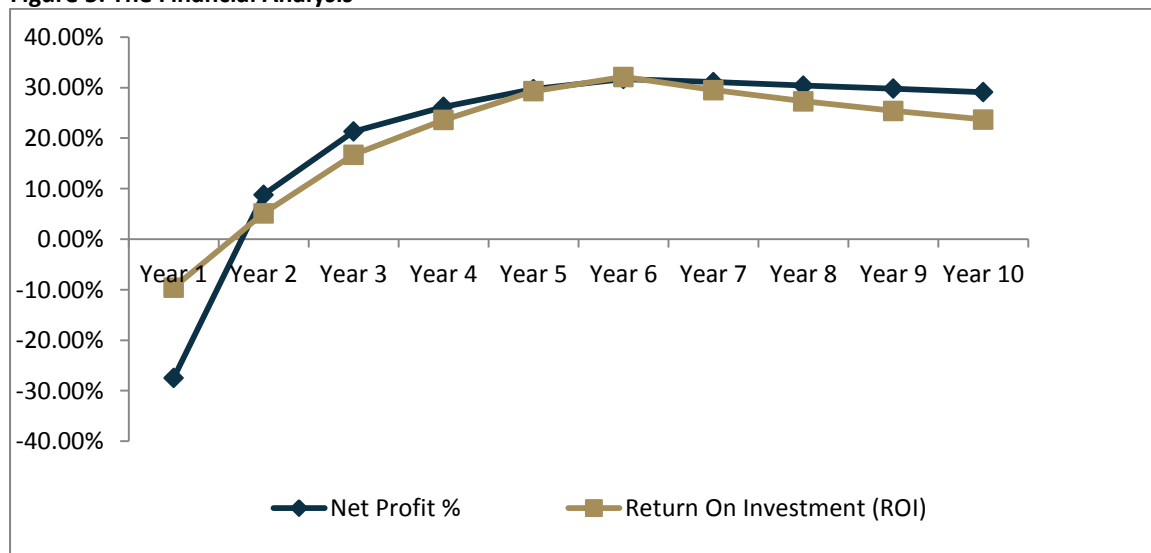
### Financial Analysis

The following table shows the financial analysis of the project. It indicates that the net profit ratio will increase from 8.8% in the second year to 29.1% in the tenth year, and the return on investment will increase from 5.1% in the first year to 23.7% in the tenth year.

**Table 31: Financial Analysis**

Financial Analysis (In Thousand JD)										
Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Assets	1,327	1,295	1,308	1,350	1,421	1,525	1,676	1,829	1,983	2,137
Revenues	462	751	1,026	1,216	1,403	1,547	1,593	1,641	1,690	1,741
Profits	(127)	66	218	319	416	490	495	499	503	506
Capital (Equity)	1,042	1,042	1,042	1,042	1,042	1,042	1,042	1,042	1,042	1,042
Net Profit %	-27.5%	8.8%	21.3%	26.2%	29.7%	31.7%	31.1%	30.4%	29.8%	29.1%
Return On Investment (ROI)	-9.6%	5.1%	16.7%	23.6%	29.3%	32.1%	29.5%	27.3%	25.4%	23.7%
Return On Capital (ROC)	-12.2%	6.4%	21.0%	30.6%	39.9%	47.0%	47.5%	47.9%	48.3%	48.5%
Net Profit On Revenues	-27.5%	8.8%	21.3%	26.2%	29.7%	31.7%	31.1%	30.4%	29.8%	29.1%
Assets Turnover (Time)	0.35	0.58	0.78	0.9	0.99	1.01	0.95	0.9	0.85	0.82

**Figure 5: The Financial Analysis**



### Economic Analysis

The following table shows the economic analysis of the project during the first ten years, we conclude that:

- The Internal rate of return is 20.8%. It exceeded five times the return on assets, which means the economic feasibility of the project
- The present value of the project reached about JD 1.8 million. It exceeds the investment with JD 1,042 million, which means the economic feasibility of the project.
- The profitability index of the project reached 1.77 times, which means that the expected value of the project will increase by two times the investment value, which proves that the project is feasible.
- The project payback period is 5.7 years.

**Table 32: the Economic Analysis**

Economic Analysis (in Thousand JD)											
Statement	Year of incorporation	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Net cash flow from operating and investing activities	(1,042)	(257)	(6)	150	270	368	464	539	543	546	549
terminal value											2,058
Net Cash flow	(1,042)	(257)	(6)	150	270	368	464	539	543	546	2,606
Internal Rate of Return (IRR)	20.8%										
Present Value	1,842										
Net present value	800										
Profitability Index (Time)	1.77										
Payback period (Year)	5.7 Years										

### Social Analysis

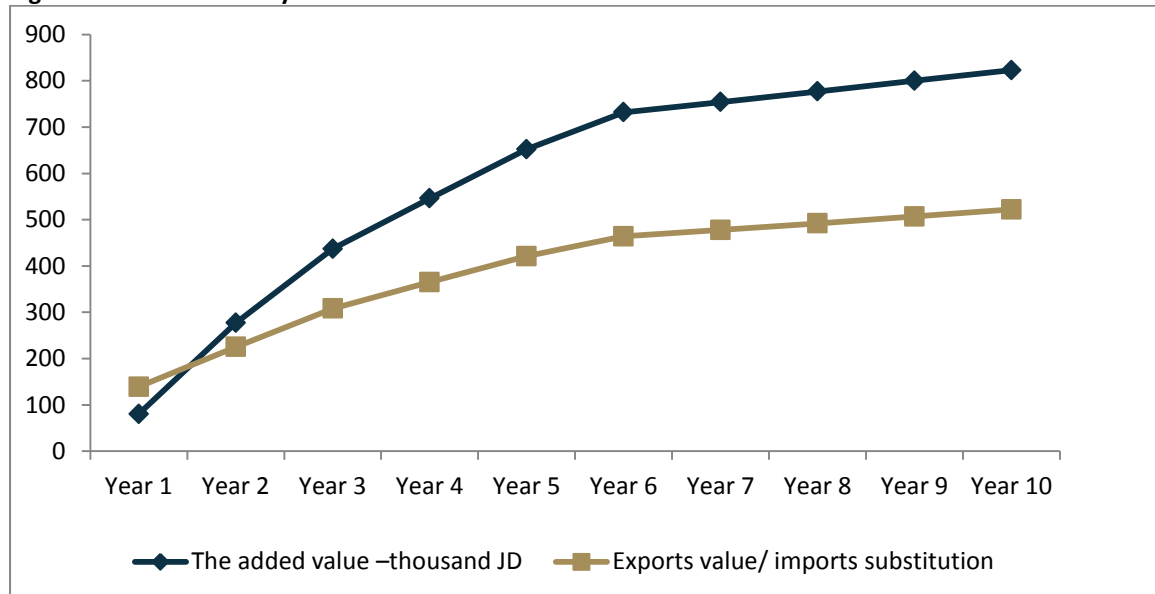
The following table shows the social analysis of the project. It is noticed that the number of staff required for the project will increase from 29 employees in the first year to 45 employees in the tenth year. The number of Jordanian employees will represent 70% of the total staff.

The added value of the project will also increase from JD 90 thousand in the first year to JD 823 thousand in the tenth year. The export value will also increase from JD 139 thousand in the first year to reach JD 522 thousand in the tenth year.

**Table 33: the Social Analysis of the Project**

Social Analysis										
Statement	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Number of Employees	29	30	32	34	35	37	39	41	43	45
Jordanian employees	20	21	22	23	25	26	27	29	30	31
The added value –thousand JD	80	277	437	546	652	732	754	777	800	823
Income tax –thousand JD	-	-	-	-	-	-	-	-	-	-
sales tax value –thousand JD	-	-	-	-	-	-	-	-	-	-
Exports value/ imports substitution	139	225	308	365	421	464	478	492	507	522

**Figure 6: The Social Analysis**



## 6. Risk and Sensitivity Analysis

### 6.1 Risk Analysis

The following table shows the risk matrix analysis that may face the project.

**Table 34: Project Risk Matrix**

Risks	Type of Risks	Risk Assessment
<b>Financial Risks</b>	<ul style="list-style-type: none"> <li>▪ <b>Credit Risk</b> Credit risk represents the risk of the company's financial loss as a result of the customer's default of the contractual obligation or that of the party dealing with the company through a financial instrument. These risks are mainly caused by trade receivables and others.</li> <li>▪ <b>Liquidity Risk</b> Liquidity risk is the risk resulting from the company's inability to meet its financial obligations at time. The company's liquidity management is to ensure as much as possible that the company always maintain enough liquidity to meet its obligations as they become due and payable in normal and emergency conditions without incurring unacceptable losses or risks that affect the company's reputation.</li> <li>▪ <b>risk of currency fluctuation</b> Currency risk is the risk of the fluctuation of the value of financial instrument, due to fluctuations in foreign</li> </ul>	<ul style="list-style-type: none"> <li>▪ The financial risks that may face the company are moderate, because there are receivables in the market are estimated at two months</li> <li>▪ There is no risk of currency exchange, because the company purchases by local market sells it in the private market</li> <li>▪ There is no risk of inflation because the company's pricing is based on a periodic basis</li> </ul>

Risks	Type of Risks	Risk Assessment
	<p>currency exchange rates.</p> <ul style="list-style-type: none"> <li>▪ <b>inflation risk</b> It is the risk associated with the possibility that the inflation or the rise in the cost of living might lead to the decrease the real value of the investment.</li> </ul>	
<p><b>Business risk (sector risk)</b></p>	<ul style="list-style-type: none"> <li>▪ <b>Strategic Risk</b> It is the risk resulting from taking bad decisions by the company's management, or implementing the decisions in a wrong way, or not taking the decisions at the right time; which leads to losses or causes loss of alternative opportunities.</li> <li>▪ <b>Legal and Regulatory Risks</b> These risks are reflected as a result of non-compliance with laws, guidelines and instructions governing the work. Legal risks are caused by the company's break of the laws governing the work in the state in which the company operates. While regulatory risks arise from the company's violation of laws and standards issued by the regulatory authorities.</li> <li>▪ <b>Reputation Risk</b> Reputation risk arises from influential negative public views which result in great losses of customers or money. It includes the actions of the company's management or its employees which project a</li> </ul>	<ul style="list-style-type: none"> <li>▪ The risks are considered very low before the company's establishment, because of getting the approval of the official authorities such as municipality</li> <li>▪ Reputational risk is moderate</li> <li>▪ Market risk in the short term will be moderate because of existence of competing companies of the same level</li> </ul>

Risks	Type of Risks	Risk Assessment
	<p>negative image of the company, its performance and its relationships with customers and other stakeholders. Reputation risk also results from circulating rumors about the company and its activities.</p> <p>▪ <b>Competition Risk</b> Competition risk results from domestic and external competitors and reduces sales and profits.</p>	
<p><b>Operational Risk</b></p>	<p>Operational risk involves losses resulting from the failure of internal operations, human resources and systems. It includes:</p> <p>▪ <b>IT Risks</b> They are losses arising from downtime or systems failure due to the infrastructure, information technology, or the lack of systems, and any failure or malfunction in the systems. They include: the crash of computer systems, breakdowns in communication systems, programming errors, computer viruses and opportunities losses due to breakdown.</p> <p>▪ <b>Human Resources Risk</b> Losses caused by employees or related to them (intentionally or unintentionally). It also includes acts that are intended as methods of</p>	<p>▪ Operational risks are moderate, related of lack of irrigation water and especially at vaccination seasons</p> <p>▪ Marketing and promotional risks</p> <p>▪ plant diseases risks and the inability to control</p> <p>▪ IT risks are limited</p> <p>▪ Human resources risks are limited</p>

Risks	Type of Risks	Risk Assessment
	cheating, abusing property or circumvent the law, regulations or company policy by officials or employees, as well as losses arising from the relationship with the customer, shareholders, regulators and any third party.	
<b>State Risk</b>	State Risk includes politicians' interference, civil unrest, wars, financial and monetary policies and high level of debts.	<ul style="list-style-type: none"> <li>▪ State Risk is considered to be low, due to security and political stability; international reports indicate that State Risk is low both in medium and long terms</li> </ul>



## 6.2 Sensitivity Analysis

### First: Increase of Investment Cost By 10%

The following table shows the results of the sensitivity analysis when investment cost increases by 10%.

**Table 35: Investment Increase by 10%**

Index	Base	Impact	Change
Internal Rate of Return (IRR)	20.8%	19.4%	1.4%
The Present Value (in Thousand JD)	1842.4	1843.8	-1.4
Net Present Value (in Thousand JD)	800.2	695.1	105.1
Profitability Index (Time)	1.8	1.6	0.2
Payback period (Year)	5.7	6.4	-0.7
The Net Profit Ratio – an average of 10 years	21.0%	20.8%	0.3%
Return on Investment - an average of 10 years	20.3%	18.9%	1.5%
Return on Capital – an average of 10 years	32.5%	29.3%	3.2%
Net Profit On Revenues - an average of 10 years	21.0%	20.8%	0.3%
Assets Turnover (Time) – an average of 10 years	0.8	0.8	0.1
The added value - an average of 10 years (in thousand JD)	587.7	587.4	0.3
income tax - an average of 10 (in thousand JD)	0.0	0.0	0.0
sales tax - an average of 10 years (in thousand JD)	0.0	0.0	0.0

The above analysis refers to the feasibility of investment in the project, in light of the high cost of the total investment of the project, which increased by 10%. It is noted that:

- The internal rate of return reaches 19.4%, which is considered high for investment purposes
- The new payback period is 6.4 years, and it is reasonable for recovery purposes
- The return on capital is 29.3%, which is suitable for investment purposes

**Second: Reducing Revenues by 10%**

The following table shows the results of the sensitivity analysis when reducing revenues by 10%.

**Table 36: Reducing Revenues 10%**

Index	Base	Impact	Change
Internal Rate of Return (IRR)	20.8%	13.8%	7.0%
The Present Value (in Thousand JD)	1842.4	1116.1	726.3
Net Present Value (in Thousand JD)	800.2	73.9	726.3
Profitability Index (Time)	1.8	1.1	0.7
Payback period (Year)	5.7	7.9	-2.2
The Net Profit Ratio – an average of 10 years	21.0%	12.3%	8.8%
Return on Investment - an average of 10 years	20.3%	14.2%	6.1%
Return on Capital – an average of 10 years	32.5%	19.9%	12.5%
Net Profit On Revenues - an average of 10 years	21.0%	12.3%	8.8%
Assets Turnover (Time) – an average of 10 years	0.8	0.8	0.0
The added value - an average of 10 years (in thousand JD)	587.7	457.0	130.7
income tax - an average of 10 (in thousand JD)	0.0	0.0	0.0
sales tax - an average of 10 years (in thousand JD)	0.0	0.0	0.0

The above analysis shows the low sensitivity of the project in case of reducing the revenues or demand by 10%. It indicates that:

- The internal rate of return is 13.8%, which is considered high for investment purposes
- The new payback period is 7.9 years, and it is reasonable for recovery purposes
- The return on capital reaches 19.9%, which is suitable for investment purposes

### Third: Increasing the Operating Costs by 10%

The following table shows the results of the sensitivity analysis when increasing the operating costs by 10%.

**Table 37: Increasing the Operating Costs by 10%**

Index	Base	Impact	Change
Internal Rate of Return (IRR)	20.8%	16.7%	4.2%
The Present Value (in Thousand JD)	1842.4	1404.5	437.9
Net Present Value (in Thousand JD)	800.2	362.3	437.9
Profitability Index (Time)	1.8	1.3	0.4
Payback period (Year)	5.7	6.9	-1.2
The Net Profit Ratio – an average of 10 years	21.0%	15.0%	6.0%
Return on Investment - an average of 10 years	20.3%	17.0%	3.3%
Return on Capital – an average of 10 years	32.5%	25.3%	7.1%
Net Profit On Revenues - an average of 10 years	21.0%	15.0%	6.0%
Assets Turnover (Time) – an average of 10 years	0.8	0.9	-0.1
The added value - an average of 10 years (in thousand JD)	587.7	513.3	74.4
income tax - an average of 10 (in thousand JD)	0.0	0.0	0.0
sales tax - an average of 10 years (in thousand JD)	0.0	0.0	0.0

The above analysis shows the feasibility of the project in light of increasing the operating costs of the project by 10%. It indicates that:

- The internal rate of return is 16.7%, which is considered high for investment purposes
- The new payback period is 6.9 years, and it is reasonable for recovery purposes
- The return on capital is 25.3%, which is suitable for investment purposes

## **7. Annex 1: Soilless Agriculture (Cultivation)**

Soilless Agriculture is a method of cultivating plants without soil, where the natural soil is replaced by a water growth media or solid media, such as volcanic tuff or Perlite and others, with the addition of nutrients in the form of nutrient solution. Through this technique, the quantities of water, nutrients and environmental conditions are controlled to be suitable for growth in order to maximize production and saving more water for irrigation. Although the idea of using hydroponics has been hundreds of years, interest in the use of this technology in agriculture has developed rapidly over the last twenty years, after showing their economic feasibility, especially in the cultivation of vegetables, cut flowers and green fodder.

Hydroponics technology is currently used in many countries of the world for commercial agricultural production, as the area has now reached more than 120 thousand acres in the world, including the United Arab Emirates, Egypt and Sudan. There have been attempts to use such technology in Jordan for more than 15 years but have not continued. On the other hand, the Ministry of Agriculture in Jordan encourages the use of this type of agriculture through the Directorate of Land and Irrigation, as the Ministry trains people on the production of Hydroponics products using Aquacorp.

### **Features of soilless agriculture compared to traditional soil agriculture**

- Efficiency in rationalizing water use in irrigation, due to lack of steam loss or drainage in the soil, with recycling of water use. Thus maximizing water use efficiency.
- High efficiency of soilless productivity, because of the availability of nutrition and water near the roots. Thus reducing root growth and directing nutrition to vegetative and fruit growth. In addition, the productivity of the area unit increases with vertical cultivation.
- High efficiency in fertilizer use, due to the ease of adjustment of its concentration, with no loss or fixation in soil. Thus increasing the nutritional efficiency of the plants.
- Reducing the use of chemical pesticides significantly with the possibility of protecting crops in ways other than chemicals, and thus have a higher crop quality and environmental protection.
- It is considered one of the most efficient methods used to solve soil issues, such as the high salinity issue, weeds, soil diseases and pests such as nematodes, insects or others.
- Savings in labor due to the lack of need for many agricultural processes in soilless agriculture, such as tillage, weeding and others.
- Agricultural intensification and increasing the number of plants in the area unit, which leads to an increase in crop production and early harvest, and thus leads to higher yield of the crop. In addition, there is a possibility of increasing the number of agricultural varieties per year.
- The possibility of agricultural production in areas where agriculture is impossible by other methods.
- The quality of the produced crops is higher, as the only the fertilizer needed by the plant is used and from natural elements. The Hydroponics product contains all the major elements needed by the human body, because they are all being supplied to the plants in a soluble way and available to the plant.
- Environmentally friendly since the residues of fertilizers are recycled, while in traditional soil agriculture, fertilizers are discharged into the lower layers of the soil leading to contamination of the groundwater.

### **Constraints of Soilless Agriculture**

- Any failure of a hydroponics system leads to rapid plant death due to the lack of soil acting as an insulator.
- Infection with pathogens, such as wilt and verticillium caused by high humidity levels, which requires more control.
- Requires more energy.
- High establishment cost.
- The need for skilled and trained management and manpower to ensure the success of the project.

**Agriculture in Solid Media:** Plants are grown in solid media such as volcanic tuff, Perlite and sand, which are placed in basins, pots or other, and considered the most prevalent in agriculture systems. The closed system is usually used to rotate the nutrient solution and reuse it several times.

### **Requirements for Establishing a Soilless Agriculture Project**

- Establishing a protected greenhouse, and its accessories from cooling systems, irrigation tanks and others.
- Establishing systems of agriculture inside the greenhouse, and accessories of irrigation systems and others.
- Nutrient solution (fertilizer and water) for irrigation.
- Agriculture environments (media).
- Supplies of plant services of fastening strings, traps and other
- Production of seedlings for agriculture.

### **Protected Greenhouse**

The protected Greenhouse is the facility used to grow crops of vegetables, flowers and others. It has a controlled indoor climate using cooling, ventilation and heating devices to ensure optimum conditions for optimal plant growth such as heat, humidity and lighting, as well as protection of plants from wind, sand storms, rain and others.



### **Conditions to consider when building a protected Greenhouse**

- Choosing the appropriate direction for protected Greenhouse that allow maximum access of sunlight (North-South).
- It is recommended to have natural windbreaks on site.
- A permanent source of water shall be provided.
- Raising the protected Greenhouse location from the level of the surrounding land, to facilitate the rapid discharge of rainwater and others.

- The Greenhouse coverings shall be able to withstand the prevailing environmental conditions, taking into consideration light permeability (polycarbonate)
- Providing a two-door entry, to reduce insect entry and avoid exposure to direct winds into the houses.
- The length of the protected Greenhouse shall not exceed 36 m and a width of 8 m, for the efficiency of cooling and ventilation at high temperatures, an a height of 3.5-4 m.

### **Components of the protected Greenhouse**

The protected Greenhouse consists of the following main parts:

- The Structure (ceilings, pillars, arches, columns).
- The foundations - facades and doors – sides.
- Covers (plastic - polycarbonate - glass ...).
- Ventilation – Cooling Equipment.
- Shading Materials
- Irrigation and fertilization systems.

### **The Shape of the Protected Greenhouse**

There are two common forms in dry areas:

1. It has a curved roof (semi-circular), and is the most common to reduce the sun's acute entry and heat accumulation.
2. The ceiling is in the form of gable.

### **Ventilation and Cooling System**

- Cooling of greenhouses is an indispensable necessity, especially during the summer months, when the average monthly rate of temperature is 37.
- Cooling system with humidification (desert) is used, because it is less expensive than other systems. It is made up of two suction fans, while on the other side there are Evaporative Cooling Pads. The Pad is about 180 cm high and at least 4 inches thick, and almost the same width of the house from the inside. The bottom edge of the Pad shall be about 30 cm high on the house floor, to minimize the possibility of soil entering into the Pad. The cooling system is operated automatically by an electric plate attached to a special heat regulator.

### **Agriculture Environments (Growth Media)**

There are many materials that can be used as a media (environment) for soilless agriculture, and the materials vary among themselves by their nature and natural properties. Due to the diversity of the forms and types of the materials in the environment, a set of foundations must be set to choose the appropriate material to be an agricultural environment.

### **Conditions to be met in Soilless Agriculture environments:**

1. The environment shall have the ability to retain water. The ability of the environment to retain water and discharge excess water depends on the size, shape and pores of the environment. The smaller the granules, the greater the capacity of the environment to retain water, as the irregular form granules have a larger surface area than the smooth and round ones, thus having a higher water retention capacity. Therefore, the size of the

granules should be suitable to keep adequate water proportion suitable to the type of crop to be cultivated.

2. The environment shall have good drainage and ventilation: The environment shall have good drainage, as it facilitates the excess water drainage that the environment cannot hold, to ensure good ventilation in the environment of root growth. Thus, it must be avoided that the environment granules are very soft as this will reduce ventilation.
3. The environment shall be free from harmful or toxic substances that can damage plant roots or affect plant growth in this environment.
4. The environment shall support plants that grow in them: The ability of the environment to strength roots depends on either the environment to be heavy, or to be linked strongly to the plants roots, and works to stabilize the plant.
5. The environment shall be free of pathogens: The environment shall be free of pests and insects when used, so as not to be a source of infection for their plants with different diseases.
6. The environment shall be free from salinity.
7. The environment shall be free of weed seeds.
8. The environment shall be slow decomposition: to remain as long as possible with the best specifications. This reduces the costs of changing the environment annually.
9. The ease of transporting and circulating the environment, and the low prices of the environment.
10. The substance shall be inert, and does not interact with the nutrients, and it shall have neutral acidity (PH).
11. Can be recycled for repeated use, or easily disposed of without environmental impacts (for example, the volcanic tuff can be used).

### **How to Establish a Soilless Agriculture System**

To establish a Soilless Agriculture project, we do the following:

- Determining the used Soilless Agriculture system (for example in cement basins, bricks, pots, etc.)
- Leveling the Land and making the slope.
- Designing and establishing the agricultural basins.
- Preparing the nutrient solution tank.
- Distributing the growth media in agricultural basins.
- Design and install the irrigation system.
- Planting in basins.

### **Establishment of a Soilless Agriculture System / Cement Basins and Bricks**

- Land leveling and making the slope: To determine and make the slope we need a transparent water pipe and water balance, as the the degree of inclination is 1:50.
- Bricks basins: The slope of the channel in the soil is determined first so that the slope is 100:1. The bricks (4 inches) are then installed on both sides of the channel and on the same slope, so that the internal distance between the lines of the blocks is 20cm. The house is divided into four basins (longitudinal lines) for cultivation.
- Covering the basins with black plastic: the bricks basins are covered with black plastic with a thickness of 100-120 microns and a width of 100-150 cm, and have the same length of the

house from one end to the other, and installing black plastic inside the basin. It is preferable to install two layers of plastic to prevent any leakage of the solution to the bottom of the basin.

- The growth medium is placed directly in the basins.



#### **Model for the Irrigation and Drainage Network**

- Irrigation and fertilization system: The adopted system is the drip irrigation system containing a main PVC pipe with eight dripping lines 4 liters per hour, and the distance between the points is 30 cm. in addition, a polyethylene spigot to be installed at the beginning of each line.
- The nutritious solution tank is placed inside the protected greenhouse.
- Operating panel: Irrigation system operating panel consists of:
  - Contactor.
  - Overload Relay.
  - Timer.

#### **Other used devices**

- Programmer
- Irrigation Pump

#### **Planting Process**

- Plants are grown directly such as roses, carnation, bulbs and annuals.
- To produce Plants, seeds are grown in agricultural trays filled with a mixture of Peat Moss and perlite. After the growth of the plant in the nursery or the plantation area, they are moved to be planted in the assigned growth soil.
- The propagation of plant is done through the propagation by cutting.
- The distance between the roses plant is about 30 cm - 50 cm where the agriculture is based on two rows.

#### **Greenhouses (Soilless Cultivation (Pozzolana))**

- The production of flowers in the form of agriculture without soil (Pozzolana) is one of the agricultural methods that have high financial returns . Also, It can produce various fruit trees such as Berry trees or Blackberry and others.
- Increase the production and quality in soilless agriculture (Pozzolana) varies between 30% and 40%. This goal can be achieved through given the plants the nutrient requirements.



- Soil-free farming (Pozzolana) is saving irrigation water in a percentage ranging between 35% and 50%. This is mainly because of the reuse of water in irrigation several times. It will also save fertilizer in the amount of 60% - 80%.
- Such method can save the expenses with regard to agricultural service operations such as tillage and weeding, and thus can achieve similar savings in the labor force

#### **How to Prepare a Nutrient Solution**

- Solution A is mixed by dissolving 1003 g of calcium nitrate in water, and then adds 79 grams of Iron Chelate and stir until dissolution.
- Solution B is mixed by dissolving each of the following substances: 263 g of dipotassium phosphate, 583 g potassium nitrate, 513 g magnesium sulphate, 6.1 g manganese sulphate, 0.39 copper sulphate, 1.7 g boric acid, 0.37 g of ammonium molybdate and 0.44 g of zinc sulphate.
- Mixing the nutritious solution for use: In order to obtain the solution ready to use, the concentrated solution (A) and (B) are diluted 100 times, which means adding 10 liters of solution A and 10 liters of solution B to 1000 liters of water.

#### **Picking Flowers**

The following tips and instructions for picking flowers should be followed in order to maintain the freshness and the quality of these flowers as much as possible: The process of picking flowers goes as the following:

- The flowers should be picked in the appropriate ripening time depending on the ability of each species of these flowers to bloom after the being picked.
- Picking flowers must be done either early in the morning or at sunset.
- Clean tools should be used for picking the flowers like scissors. The tools used for picking should be sharp so as not to damage the tissues of the plant.
- Initial cooling of flowers should be done after picking up the flowers by the use of cold or iced water. The flowers should be put in a humid place and any substances that impede water entering the flowers' necks should be eliminated.
- The flowers should be classified according to the degree of their bloom, height, color, flower diameter and the general condition.
- The flowers should be packed in bunches according to their quality.
- The flowers must be transported as quickly as possible to the places of sale or storage with appropriate environmental conditions to preserve the freshness and quality of the flowers.
- The mechanical damage that such flowers may experience should be minimized to as little as possible in order to prolong the flower's life and maintain its life for exportation.