Business Plan Report

Permaculture Design and Business Plan for Sustainable Livelihoods Programming: Low-Cost, Sustainable Solutions for Food and Nutrition Insecure Agro Pastoral Communities in Jordan

Strengthening Innovation and Technology Adoption towards Sustainable Agricultural Productivity in Arab Countries

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LIST OF ACRONYMS

AFESD	Arab Fund for Economic and Social Development
BCR	Benefit Cost Ratio
CGIAR	Consultative Group on International Agricultural Research
Du	Dunum (1 du=0.10 ha)
ICARDA	International Center for Agricultural Research in Dry Areas
JD	Jordanian Dinar (1 JD= 1.41 US$)
Kg	Kilogram
NARC	National Agricultural Research Center
$	United Stated Dollar
PI	Profitability Index
PB	Payback Period
PIR	Profit Investment Ratio
R4D	Research for Development
ROI	Return on Investment
IRR	Internal Rate of Return
WHT	Water Harvesting Techniques

KEY MESSAGES

Summary

There is a serious threat posed to human survival by food insecurity, especially among vulnerable communities such as agropastoral living in dry land areas. The overwhelming effects of the land degradation, low productivity, and food insecurity in the agropastoral farming systems have again called attention to the need for a longer-term response to the problems of food security and rural development in the agropastoral dry areas. Evidenced climate change threats, water scarcity, and resources degradations are the main factors that have exacerbated these problems. They will continue to do so until more sustainable responses are in place. Solving these problems will require an integrated approach that encompasses the main themes of this volume. These include managing productive resources throughout the climate change threats, understanding ways to promote change, and managing dryland resources. There is considerable accumulated experience on options to help tackle these problems.

One development approach that shows promise for agropastoral farming systems communities programming, particularly in a dryland context, is permaculture. Therefore in the frame of the Strengthening Innovation and Technology Adoption towards Sustainable Agricultural Productivity in Arab Countries project and under the diversification of agropastoral system-based value chains activity, the International Center for Agricultural Research in the Dry Areas (ICARDA in collaboration with the National Agricultural Research Center (NARC) designed and implemented this technique in the agropastoral region of Jordanian *Badia* called *Al Majidyya* . Thus, the aim of this report is to provide a business plan regarding the implementation of this technique and to provide an overview of its programming as a response to food and nutrition insecurity for agropastoral communities. It emphasizes the role of permaculture as a sustainable, non-donor dependent tool for improving the health, food and nutrition security, and livelihoods of agropastoral communities and their families

Such concept is a type of agriculture system which has been designed and implemented one year ago following a logical based process to make the system more sustainable in this agropastoral area. Indeed, the aim of this experiment “permaculture” in this agropastoral farming system is to restore soil, conserve water, and redirect waste streams. At the end, its principle is to make a crop production system by considering the function of each plant and the interaction between plants in which the components inside are mutually beneficial to each other in this specific agropastoral context. There are many techniques through the project with available inputs in order to enhance food security and water saving to improve livelihoods through increasing income and give farmers’ self-sufficiency through home manufacturing of farms food products. These techniques summarized in, water harvesting techniques (WHT) (rooftop water harvesting, swale, and water pond), compost manufacturing, wicking beds systems and chickens’ tractors systems which will lead to generate Income. The elaboration of a business model for permaculture farming system in a selected household in Al Majidyya village (Jordan) reveal the potential profitability of investing in this technique in the dry land areas. Both economic and financial indicators (BCR, IRR, NPV, etc.) support the profitability of this business. This implies a transition from conventional production system in agropastoral towards an array of sustainable regenerative production systems that improve productivity with limited resources. Furthermore, shifting from the current approach in agricultural management in these farming systems is necessary. An approach that acknowledges the role of people as not mere producers of food, but also as managers of ecological systems that produce a suite of ecosystem services is needed.

Keywords

Permaculture; business model; low cost technology; household; agropastoral communities, Jordan.

Highlights

- Permaculture is a potential development tool for managing dry land resources that shows promise for agropastoral farming systems communities programming.
- Permaculture is a low cost and profitable sustainable solution for food and nutrition insecure agropastoral communities.
- Permaculture is relevant technology to the agropastoral farming systems communities.
- The benefits associated with permaculture from economic return is increased savings from reduced input, high yields, and affordability of this technique.

I. INTRODUCTION

There is a serious threat posed to human survival by food insecurity, especially among vulnerable communities such as agropastoral living in dry land areas. The overwhelming effects of the land degradation, low productivity, and food insecurity in the agropastoral farming systems have again called attention to the need for a longer-term response to the problems of food security and rural development in the agropastoral dry areas. Evidenced climate change threats, water scarcity, and resources degradations are the main factors that have exacerbated these problems. They will continue to do so until more sustainable responses are in place. Solving these problems will require an integrated approach that encompasses the main themes of this volume. These include managing productive resources throughout the climate change threats, understanding ways to promote change, and managing dryland resources. There is considerable accumulated experience on options to help tackle these problems.

One development approach that shows promise for agropastoral farming systems communities programming, particularly in a dryland context, is permaculture. Permaculture is an innovative framework for creating sustainable agriculture through developing ecologically harmonious, efficient and productive systems that can be used by anyone, anywhere. Permaculture is a sustainable design system stressing the harmonious interrelationship of humans, plants, animals and the Earth. According to Bill Mollison "*The core of permaculture is the designing, the working relationships and connections between all things*". By thinking carefully about the way, we use our resources - food, energy, shelter and other material and non-material needs - it is possible to get much more out of life by using less. We can be more productive for less effort, reaping benefits for our environment and ourselves, for now and for generations to come. This is the essence of permaculture - the design of an ecologically sound way of living - in our households, gardens, communities and businesses. It is created by cooperating with nature and caring for the earth and its people.

Permaculture is a framework that works toward sustainability of human habitats. It maximizes the use of local resources, applying ecological principles to meet human needs for food, shelter, energy, and a sense of community. In the context of agropastoral farming systems communities programming, permaculture helps guide communities toward permanent solutions for food and nutrition security while ensuring that these options exist harmoniously within their environment. Importantly, bringing a perpetual source of food and nutrition to agropastoral farming systems communities through households, schools, and other community institutions is only one aspect of what permaculture offers to agropastoral farming systems communities programming. It also offers opportunities for income generation, and on a more comprehensive level, it teaches local actors about their relationship with the environment and how to meet their needs in a responsible, environmentally friendly way (Didarali and Gambiza, 2019).

Within the global sustainable development goals particularly to end hunger and achieve food security, there is a need for viable solutions to the global hunger problem, particularly focusing on sustainable agricultural practices that will increase yields and also protect the environment in the agropastoral communities. Thus, in the frame of the Strengthening Innovation and Technology Adoption towards Sustainable Agricultural Productivity in Arab Countries project, the International Center for Agricultural Research in the Dry Areas (ICARDA in collaboration with the National Agricultural Research Center (NARC) proposed permaculture as a model of smart farming in the agropastoral communities. This initiative has been designed, implemented, and evaluated as a holistic design framework that incorporates sustainable agricultural practices, potentially improving livelihoods in a selected household in *Al Majidyya village.*

The report will then look into the implementation of the permaculture business model in *Al Majidyya* village of Jordan. There is limited literature on the application of permaculture in

Jordan's arid and semi-arid as a means to sustainable food security as well as additional income sources. This study looks into alternative methods of agropastoral agriculture that are sustainable as well as environmentally friendly. It relies heavily on primary data collected from *Al Majidyya* households. This will allow for sound conclusions on whether the permaculture model can be used to bring food security to the agropastoral farming systems communities. This permaculture business model experience forms the core of this technical document on dryland characteristics, policies, crops, soils and water, livestock, and ways to stimulate people to make the most of the strengths of individuals, their communities and organizations in the dryland areas.

II. OBJECTIVES OF THE STUDY

As indicated in the section above, there is limited literature on the application of permaculture in Jordan's arid and semi-arid as a means to sustainable food security, additional income sources as well as ways for managing dryland resources. It is therefore important to look for new, innovative ways to provide options via sustainable agropastoral agriculture that harnesses productive yet safe methods of food production in these challenging farming systems.

The general objective of the study is to assess the impact of application of the permaculture farming model in the agropastoral community at the household level. It is mainly to provide an overview of permaculture programming as a response to food and nutrition insecurity for agropastoral communities. It emphasizes the role of permaculture as a sustainable, non-donor dependent tool for improving the health, food and nutrition security, and livelihoods of agropastoral communities and their families. Particularly, this study aims:

- To argue for the implementation of the permaculture model alongside agropastoral communities as a sustainable solution to food insecurity in the dry land areas.
- To evaluate whether the permaculture business model can be replicated to other arid areas in the region.
- Identify the implementation challenges and make recommendations on how to overcome those challenges in these specific farming systems, and in other communities interested in applying permaculture within their specific contexts.

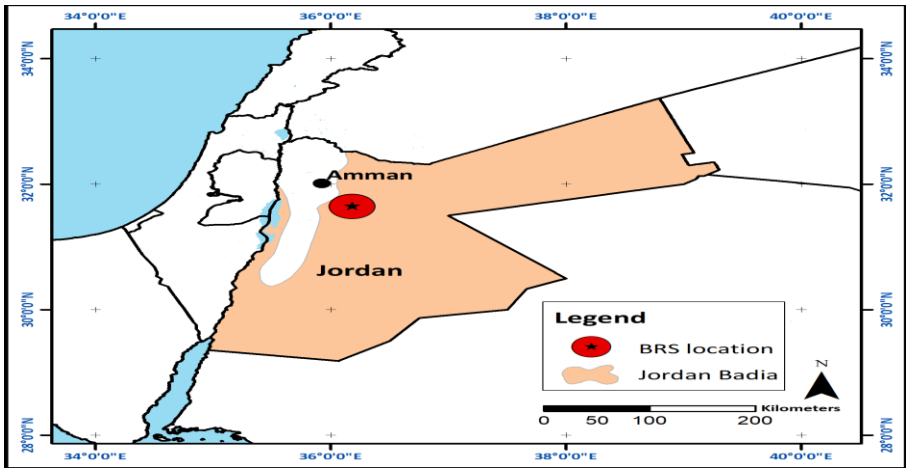
III. PERMACULTURE BUSINESS PLAN FRAMEWORK

III.1. The site of the study and units of analysis

This study has been implemented in a selected household in the rural communities of *Al Majidyya* village at *Al Muwaqer* district, which is located in the southern part of Amman, with a population of (441 inhabitants, and the number of households is (40) families, the family number range is about (5) members. *Al Majidyya* centered at the latitude 31.742452; the longitude is 36.116534 with an average elevation of 831 m above sea level. The average rainfall is around 130 mm, and the estimated area is (600) dunums, and the farmers' land holdings vary from (0.5 to 60) dunums (Figure 1).

The old name of the former area, "*Al-Matabba,*" has been changed to *Al Majidyya*. The residents of *Al Majidyya* are from the same family, which is the *Bani Sakhr* tribe. The houses in the area are characterized by concrete buildings, some of them are built from stone, and everyone lives in his own home. The units of study will be one household in the village who was engaged with the project teams on implementing this model.

Figure 1: Location of Al Majidyya in The Hashemite Kingdom of Jordan



Source: Strohmeier et al., 2021.

III.2. Data collection and methodological analysis

This study adopted a mixed methods approach, which combines philosophy, research design, and orientation methods. It is a procedure for collecting, analyzing, and mixing both quantitative and qualitative research methods within a study. The use of such an approach allowed for a greater understanding of research problems, in comparison with the use of only one approach (Creswell et al. 2011). Empirical data was collected through rapid rural appraisal questionnaire, interviews, and observation in *Al Majidyya* community. The study applied also content analysis to analyze the challenges and benefits associated with permaculture in this farming system. Moreover, recurring themes were assessed that emerged from the participants' responses.

III.3. Permaculture project description

To understand if the permaculture model can be implemented alongside agropastoral communities as a sustainable solution to food insecurity and how can the permaculture model be replicated to other arid areas in the dryland areas, it is worth to mention that permaculture introduced new technologies and increased farmers' performance to their lands and recourse to improve soil properties and increase productivity in the agropastoral community of Jordan (i.e. *Badia*). These projects techniques summarized in, Water Harvesting Techniques (WHT), compost manufacturing and Income generation systems.

III.3.1. Income generating systems

III.3.1.1. Wicking beds systems

Wicking beds systems use a cheap container where prevent water from leaving the bottom of the soil bed with a waterproof liner or layer. This creates a water reservoir *underneath* the soil. Then, rather than having to irrigate by watering from above (via drip irrigation, a hose, watering can etc.), the water literally *wicks u*p into the soil from below, via a process called capillary action keeping it nice and moist. It is a useful system in arid places where there is lack in water such as residential places in arid rural communities (usually their especial space is around the house, parks, schools etc.). This system is designed to supply the plant with water for up to several weeks depending on the season's climate and location where it creates a constantly moist environment storing water under the soil surface, which reduces evaporation and ensures plant sufficiency of water. The advantages and limitations of these systems are outlined below.

System advantages

- Consumes 80% less water and reduces evaporation.
- Requires less amounts of maintenance.
- The problems of the undesired herbs are less because the surface of the soil is drier.
- Vegetables, beans, sage and thyme can be planted together in a wicking bed.

System Disadvantages

- Permaculture can be risky due to short-term losses vs. long-term gains.
- Knowledge regarding permaculture is still rather limited.
- Permaculture involves plenty of work for that it can look quite messy.

III.3.1.2. Chickens tractors

A chicken coop which farmers can move from place to place lacks a floor allowing chickens to scratch and till the topsoil and eat grass, weeds, and bugs because there isn't a floor and the manure drops directly onto the ground and helps fertilize the soil. Chicken tractors can allow farmers to maintain the health of their land through rotational grazing. In this system, chickens can be systematically moved from location to location and minimize the impact on anyone's area for too long, so the periods of disturbance are followed with periods of rest in order to allow re-growth. At the same time, the temporary disturbance is good because it allows the chickens to mix and fertilize topsoil; this is better for the soil than mechanical tilling because it leaves the soil structure intact and preserves the soil life. Both men and women can handle raising chicken especially if chicken tractor placed at the house garden or house surrounding and it can be income resource for woman.

III.3.2. Water harvesting techniques

III.3.2.1. Water harvesting techniques

Harvesting of rainwater can be from roofs of houses, private, public or commercial buildings to enhance secure water supply for domestic use such as sanitation or garden irrigation. This method involves a catchment area from one or more roofs, a storage tank, and gutters and pipes to guide the water from the roof into the storage tank so it provides an interesting alternative resource for irrigation if irrigation water from other sources is not readily available or is too costly specially when there is no government water network exist in the targeted region

III.3.2.2. Swale

A swale is a counter line to collect surface runoff water from a small catchment area where water is collected in trenches designed and excavating through the use of a total station device to measure and determine: earth site, the entire land area of specific location, the highest point in the plot, the lowest point, the coordinates of slopes and altitude difference, the direction of movement of water surface runoff in order to dig a counter line along the water direction steam to collect water surface runoff.

III.3.2.3. Water ponds

Creating such systems are considered efficient water harvesting techniques and soil moisturizing systems small reserves of surface water, such as lakes or ponds, and keeping the water from leaking into the soil by making them watertight so that the water can be kept for longer time and the population can have a water supply during the dry seasons. Creating reservoirs or ponds are simple way to conserve rainwater and provide a nearby store of water that can be used for various needs to reduce the difficulties faced during the dry seasons. These sorts of water reserves are particularly useful in areas where rainfall is irregular throughout the year and in the dry periods; they become a nearby source of water that can be used for watering livestock and irrigate plants.

III.3.3. Composting manufacturing

Compost is rich in nutrients and can be used in gardens, landscaping, horticulture, and agriculture. It is beneficial for the land in many ways as a soil conditioner, fertilizer, addition of vital humus or humic acids, and as a natural pesticide for soil. It can be a cheap alternative source for fertilizer which uses the remains of agriculture and food (waste food) instead of the chemical's fertilizer. There are two types of manufactured fertilizers:

1. Animal: sheep manure and chicken waste
2. Plant: kitchen remains, grass plant, weeds, falling and green leaves and remnants of pruning trees.

Compost is a key ingredient in organic farming that requires making a pile of wet organic matter known as green waste (leaves, food waste) with animal manure and waiting for the materials to break down into humus after a period of weeks or months.

III.4. Permaculture business model

III.4.1. Market analysis

Permaculture Product Description
Permaculture gardening is working with natural forces: the wind, the sun, and water to provide food, shelter, water, and everything else garden needs besides plants and seeds. And the best part is that it's all done with the least amount of labor and without destroying the land.

Target group (potential customers)
Farmers, rural women

Segmentation
Traders, Shopping Malls, Neighbors, Cooperation

Competitors analysis
This is mainly to focus on the product identity, number of competitors, distinguished product and number of competitors (It is expected that no one will be competitor). It is also critical to assess the ccompetitive advantage (i.e., what distinguishes from competitors?).

Other key elements should be considered such as:

i. The constructed permaculture systems lasted as long as possible and need least maintenance.
ii. It is an alternative form of agriculture that addresses social, economic, and environmental aspects of sustainability.
iii. The Benefits associated with permaculture from economic return is increased savings from reduced input, high yields, affordable
iv. The long-term environmental sustainability is the use of local resources and reducing dependence on chemical input.
v. Produce organic production without using chemical fertilizers and pesticides.
vi. What distinguishes permaculture from other approaches is it's a comprehensive design process. Each site, whether a garden, farm, school, or household, has a unique set of elements and design considerations.
vii. Its approach of production focuses on multi-functionality and diversity through the use of integrated water management, land use diversification, poly cultures, and perennial cropping.

Sales policy

In order to ease the communication and cooperation with the future or potential clients there is policy sale procedures which can help to define the efficient way of support for the established sales process. This is mainly through: (i) Forward sale; (ii) Cash sale or (iii) Give discounts.

Promotion

There are several types of promotions can be used include advertising, consumer promotions:

1. Advertising and press releases.
2. Personal selling (one of the most effective ways of customer relationship. Such selling works best when a good working relationship has been built up over a period of time. This can also be expensive and time consuming but is best for high value or premium products).
3. Public relations (the planned and sustained effort of public relations is to establish and maintain mutual understanding between the farmers and the customers.
4. Trade discounts.

Table 1: Expected yearly sales

Production (year)		Sales
Vegetables 16 Wicking beds (2 seasons)	No.	kg 225.5
	Price	-----
	Total	118.55*2*16 = 3793.6
Eggs (from one chicken)/ year (15 Chicken)	No.	101
	Price	0.15
	Total	15.15*15=227.25
Compost (3 times in year)	No.	60 ton
	Price	60
	Total	60*60*2=7200
Total sales (JD)		**11220.85**
Total sales ($)		**15821.4**

Source: Project team elaboration (2020).
Note: These expected sales are based on the permaculture design framework in Al Majidyya (Jordan).

III.4.2. Production plan

We mean by production plan is working things out before it happens to help farmers gain skills for better planning which is one of the stages in the farmer's decision-making process. Permaculture studies the ecosystems to discover how to work with them rather than in spite of them. By observing every element and its function in a natural system, Permaculture enables powerful, sustainable new solutions for living with and within a renewed landscape start study the location of land; topography, soil type, fertility, drainage, irrigation systems also the capital like existing buildings and introduce new structures. The table below (Table 2) provide a proposal timetable and steps for the permaculture project implementation *in Al Majidyya .*

Table 2: Timetable and steps for the permaculture project implementation in *Al Majidyya*

Task	Weeks											
	1	2	3	4	5	6	7	8	9	10	11	12
Farms Location (Maps, Geography analysis, etc.)												
Existing Buildings and Introduce New Structures.												
Develop Water Supply (considering farm water system (water storage, water harvesting, reticulation of water, Define access point)												
Subdivide Farm with, swales, contour strips and fencing												
Purchase of equipment and seedlings												
Plant Trees in contour strips, Improve farm Soil												
Animal barn place design												
Follow up agricultural service (irrigation, etc.)												
Crop harvesting												

Source: Project team elaboration (2020).

As soon as the step-by-step practice of applying permaculture design in the agropastoral communities using the Jordanian *Badia* as potential implementation site is defined, we then proceed to present the key activities including a timetable on the implementation of these activities.

Table 3: Implementation activities workplan for permaculture model

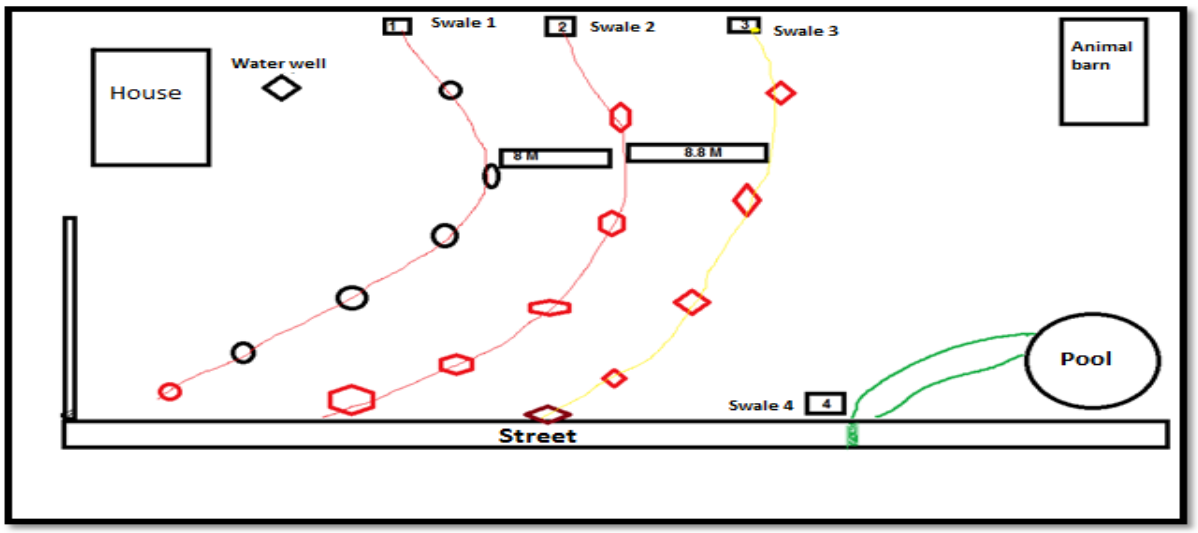
Activity	Months											
	1	2	3	4	5	6	7	8	9	10	11	12
Preparation of the Wicking beds						*	*	*				
Planting the Wicking bed								*	*	*	*	
Preparation of the Rooftop Water Harvesting									*	*	*	
Design swales (AutoCAD design)					*	*	*	*				
Preparation of the swales						*	*	*	*	*	*	*
Design Water ponds					*	*	*					
Building Water ponds									*	*	*	*
Compost manufacturing					*	*	*	*				
Chickens Tractors	*	*									*	*

Source: Project team elaboration (2020).

III.4.3. From theory to practice: Applying the permaculture design process

The cost associated with implementing permaculture in any region depends on a variety of factors. The design process (Figure 2) always begins by assessing preexisting and locally available resources and then developing design ideas based on these observations. In situations where communities can be empowered to come together to provide local resources (i.e., land, labor, etc.), implementation can be completely free, and in the long run can even generate significant revenue. Where commitment is less than ideal, a budget for permaculture tools, and other supplies may be necessary. In some cases, existing tools can be adapted for new uses.

Figure 2: Based map and zooning



Source: Project team elaboration (2020).

In the section below, we present a detailed breakdown of the upfront cost of investment including equipment, operational, and labour costs (Tables 4, 5 & 6).

Table 4: Required equipment and its respective up-front costs

#	Item	Source	Unit	Costs (JD)	Costs ($)	Life span
1	Agricultural tools (bulldozer, plow, etc.)	Markets	Rented per hour	220	310.2	
2	Wicking bed (transportation, cut tanks +gravels canvas roll+ wood ruler	Markets	16 wicking bed	580	817.8	10 years
3	Elbow, pipes, screws, plug			25	35.25	
4	Water tank + transportation			95	133.95	
5	Plastic tubes (water harvesting), tubes +cement	Markets		30	42.3	
6	Seed and Seedling	Markets		39	54.99	
7	Trees (0.15)	Markets	100 trees	15	21.15	
	Mulch or fiber	Markets		15	21.15	
	Cell raising (chicken tractor)	Markets		350	493.5	
	Compost (20-ton Livestock waste +80-ton plant waste)			230	324.3	
	Digging pool+ gravels for pool floor			160	225.6	
	Total			**1759**	**2480.19**	

Source: Project team elaboration based on Amman market price (2020).

Table 5: Operational costs

Item	Unit	Total costs (JD)	Effective period (month)
Pool	One	160	The whole year
Irrigation system	Network	250	The whole year
Swales	Three swales	300	The whole year
Wicking bed	16 wicking beds	221	The whole year
Planting	Seedling/ one wicking)	46.5-50	Seasonally
Irrigation	Rooftop Water Harvesting Tanks (summer) 15 m3(4 times)	133 100	Winter season Summer
Total (JD)		**1214**	
Total ($)		**1711.74**	

Source: Project team elaboration based on Amman market price (2020).

Table 6: Labor costs

Title	Monthly wage (JD)	No.	Months	Yearly cost (JD)
One labor or the owner of the land	220	1	12	2640

Source: Project team elaboration based on Amman market price (2020).

III.4.4. Administrative plan

An administrative plan for business is a vital component to a company's level of success. Even if a project has a great product and a well-curated marketing plan, it still needs an administrative plan to ensure the company is properly managed. This plan should include the following information:

Project name: Example – Permaculture model in *Al Majidyya*
Legal form of the project: Private ownership
Project manager: The farmer himself
Pre-operational activities: One-time payment, such as licensing fees, design, etc. It is indicated that permaculture design model is estimated at 2000 JD (2820 US$).

Administrative expenses

Administrative expenses are the costs related to the administration and general functions of the organization and are not directly related to any specific department. Sometimes it is considered a part of general commercial expenses, and these costs are meet basic needs such as renting the place, utilities or office supplies. In this context, we can consider that land rent, permanent employment salaries are administrative expenses (Table 7).

Table 7: Administrative costs

Item	No.	Unit cost	Total costs (JD)	Total costs ($)	Notes
Land rent (JD)	4 Dunum	100	400	564	-
Labor salary (JD)	1	220	2640	3722.4	An agricultural unit (30 dunums) needs one permanent labor (each dunum needs a part of the labor's time and effort, estimated at 7.3 dinars / dunum).
Total	-	-	**3040**	**4286.4**	-

Source: Project team elaboration based on Amman market price (2020).

III.4.5. Financial plan

The financial plan for a Wicking bed enterprise budget (one wicking bed) is outlined in the table below (Table 8).

Table 8: Wicking bed enterprise budget

Costs	Quantity	Price (JD)	Total (JD)
Variable Costs			
Tomato(day)	10	0.1	1
Eggplant (day)	5	0.1	0.5
Lettuce (week)	10	0.05	0.5
Mint	20	0.02	0.4
Corn	20	0.02	0.4
Onion	10	0.02	0.2
Garlic	10	0.02	0.2
Total variable costs	-	-	**3.2**
Fixed costs			
Wicking bed (Container)	1	15	15
Pipe	1	4	4
Elbow	1	1	1
Fiber or mulch	1	3	3
Water (roof water harvesting)	-	-	0
Total Fixed costs	-	-	**23**
Total costs (JD)	-	-	**26.2**
Total costs ($)	-	-	**36.94**
Revenue	**Total production**	**Price / kg**	**Total price JD**
Tomato	70	0.7	49
Eggplant	62.5	0.7	43.75
Lettuce	16	1	16
Mint	32	0.15	4.8
Corn	5	1	5
Onion	20	0.5	10
Garlic	20	0.5	10
Revenue (JD)	-	-	**138.55**
Revenue ($)	-	-	**195.35**
Profit (JD)	-	-	**112.35**
Profit ($)	-	-	**158.41**

Source: Project team elaboration based on Amman market price (2020).

Financial Feasibility of compost

- Tunnel: length 100m, width 1.20m, capacity 4 tons.
- Burial period: From three months to four months
- Number of burial times during the year: Three times during the cold months.
- Animal waste does not lose weight after burial.
- One ton of fermented organic fertilizer is enough for one dunum

Table 9: Financial feasibility of compost

No	Capital cost	Quantity	Price	Costs
1	Tunnel preparation (capacity 4 tons)	1	200	200
2	Mixing machine	1	250	250
3	Mulch (2.5 Micro)	1	200	200
4	Garden cart	1	20	20
	Total capital costs (JD)			**670**
	Total capital costs ($)			**944.7**
No.	**Operational costs**	**Quantity**	**Price**	**Costs**
1	Livestock waste	20 ton		180
2	Plant waste	60 ton		50
3	Labor	2	20	40
4	Packaging bags / capacity 50 liters	20	0.18	3.6
5	Total operating costs / to produce 80 tons	273.6		
6	Total operating costs if three times were produced during the year	820.8		
	Total costs (JD)	**1490.8**		
	Total costs ($)	**2102.028**		
No.	**Revenue**	**Quantity**	**Price**	**Net profit**
	Fermented fertilizers (organic) 2 times producing during the year	60	60	7200
	Profit (JD)			**5709.2**
	Profit ($)			**8049.972**

Source: Project team elaboration based on Amman market price (2020).

The business plan statement will be then reported as follows (Table 10).

Table 10: Business plan statement

Items	Total (JD)	Total ($)
Required equipment	1759	2480.19
Operational costs	1214	1711.74
Permaculture design	2000	2820
Administrative expenses	3040	4286.4
Total Costs	8013	11298.33
Expected sales	**11860.85**	**16723.79**

Source: Project team elaboration based on Amman market price (2020).

The assessment finding of the expected income statement (profits and losses) are outlined in the table below (Table 11).

Table 11: Income expected statement (profits and losses)

Item	Years									
	1	2	3	4	5	6	7	8	9	10
Total revenue		11860.9	12098.1	12340	12586.8	12838.6	13095.3	13357.2	13624.4	13896.9
Operational cost	1214	1226.1	1238.4	1250.8	1263.3	1275.9	1288.7	1301.6	1314.6	1327.7
Margin profit	-1214.0	10634.8	10859.7	11089.2	11323.5	11562.7	11806.6	12055.6	12309.8	12569.2
Administrative expenses	3040	3070.4	3101.1	3132.1	3163.4	3195.1	3227	3259.3	3291.9	3324.8
Net profit (before taxes)	**-4254.0**	**7564.4**	**7758.6**	**7957.1**	**8160.1**	**8367.6**	**8579.6**	**8796.3**	**9017.9**	**9244.4**
Taxes	1217.1	1248.2	1280.1	1312.6	1345.9	1379.9	1414.6	1450.2	1486.5	1523.6
Net profit (after taxes)	**-5471.1**	**6316.2**	**6478.5**	**6644.5**	**6814.2**	**6987.7**	**7165.0**	**7346.1**	**7531.4**	**7720.8**

Source: Project team elaboration based on Amman market price (2020).

The statement of the expected cash flow for the 10 years lifecycle of this project is displaced in the table 12.

Table 12: Statement of the expected cash flow for the project lifecycle

Year	Fixed costs (JD)	Variable costs (JD)	Total costs (JD)	Revenue (JD)	Cash flow (JD)
1	3759	4254	8013	-	-8013
2	0	4296.54	4296.54	11860.85	7564.31
3	0	4339.50	4339.50	12098.07	7758.56
4	0	4382.9	4382.9	12340.03	7957.13
5	0	4426.73	4426.73	12586.83	8160.10
6	0	4470.99	4470.99	12838.57	8367.57
7	0	4515.70	4515.70	13095.34	8579.63
8	0	4560.86	4560.86	13357.24	8796.37
9	0	4606.47	4606.47	13624.39	9017.91
10	0	4652.53	4652.53	13896.88	9244.34
Average	-	**4450.62**	**4826.52**	**11569.82**	**6743.292**

Source: Project team elaboration based on Amman market price (2020).

As soon as the expected cash flow is calculated, the following step will deal with the calculation of the different financial indicators. The empirical findings are outlined in the table 13.

The empirical findings reveal the profitability of this business investment under a discount rate of 3% and 6%, respectively. The group of economic factors outlined in the table below suggest an average net profit for about 5753.33 JD/year. In addition, we calculated indicators under a non-discounted profitability criterion such as profitability index (PI), known as Profit Investment Ratio (PIR), payback period (PB), and return on investment (ROI), of this project under the two discount rates. The profitability index rule is a decision-making exercise that helps evaluate whether to proceed with this permaculture project. Given the rule is that a profitability index or ratio greater than 1 indicates that the project should proceed. A profitability index or ratio below 1 indicates that the project should be abandoned. PI indicator shows a ratio greater than 1 under both scenarios. This allows to confirm the profitability of this project. The second indicator is the payback period. This indicator refers to the amount of time it takes to recover the cost of an investment. Under both scenarios, the payback period length of time an investment reaches a break-even point after 2 and 2.1 years, respectively. Thus, the desirability of an investment is directly related to its payback period. In our case, therefore, shorter paybacks mean more attractive investments.

The return on investment indicator, this financial metric used to measure the amount of return on a particular investment, relative to the investment's costs, is greater than one suggesting a gain from this investment in permaculture business relative to its costs, and consequently the profitability of this investment. This statement is also confirmed by the discounted profitability indicators (CBR and IRR).

Overall, the permaculture in this agropastoral community could be saving money business for the next 10 years, making evidence for its profitability and self-sustainability.

Table 13: Financial indicators – Permaculture business plan in Al Majidyya (Jordan)

Item	Indicators	@Discount Rate 3%	@Discount Rate 6%
Non-discounted profitability criteria	Average Net Profit (JD)	5753.33	5753.33
	Profitability Index (PI) (1 + (Net Present value / Initial investment))	13.22	10.97
	Payback Period (Years)	2	2.1
	Return on Investment (ROI)	1.51	1.51
	Break-Even Analysis (Return on sales per dinar invested)	0.2	0.2
Discounted profitability criteria	Net Present Value (JD)	45964.07	37492.37
	Benefit Cost Ratio (BCR)	1.38	1.16
	IRR (%)	89	84

Source: Project team elaboration based on Amman market price (2020).
Notes:

- *Profitability Index = 1 + (Net Present value / Initial investment)*
- *Payback period (years): The payback period refers to the amount of time it takes to recover the cost of the first investment. The payback period is the length of time an investment reaches a break-even point*
- *Return on Investment (ROI)= (Current Value of Investment−Cost of Investment)/ (Cost of Investment).*
- *Break Even Point in Units: (Total Fixed Costs/Contribution Margin per Unit)*

III.5. Potential risks

Given the fact that we are dealing with an investment, it is worth to assess the potential risks associated with this type of investment. Overall, risk is defined in financial terms as the chance that an outcome or investment's actual gains will differ from an expected outcome or return by investing in permaculture. Risk includes the possibility of losing some or all of an original investment. Quantifiably, risk is usually assessed by considering several types of risks. Risk takes on many forms but is broadly categorized as the chance an outcome or investment's actual gain will differ from the expected outcome or return. In this type of investment, four types of risk and several ways to quantify risk for analytical assessments are considered (Table 14).

i. **Financial risk**: Financial risks are considered low because permaculture techniques require use and recycle available simple tools in the farm. If they do not exist, their costs are not expensive.
ii. **Operational risk**: Operational risks are low, as agricultural supplies and agricultural services are provided in addition to the availability of expertise and labor.
iii. **Market risk**: Market risks is low due to agricultural diversification intensified towards fruits and vegetables production.
iv. **Physical risk**: Physical risks (weather, diseases) are moderate in vegetable production constrained by pests and diseases which effects are exacerbated by climate change and variability.

Overall, it is possible and prudent to manage investing risks by understanding the basics of risk, how it is measured, and what strategies and procedures that could take to reduce or mitigate these potential risks in the permaculture business plan. Learning the risks that can apply to different scenarios and some of the ways to manage them holistically will help all types of investors and business managers (i.e., dryland farmers) to avoid unnecessary and costly losses.

Table 14: Types of risks and quantification ways for analytical assessment

Risks	Probability Unlikely, likely, very likely	Impact no impact, medium, extensive	Severe Low, moderate, high
Financial risk	Likely	Medium	Financial risks are considered low because permaculture techniques require use and recycle available simple tools in the farm. If they do not exist, their costs are not expensive
Operational risk	Likely	Medium	Operational risks are low, as agricultural supplies and agricultural services are provided in addition to the availability of expertise and labor
Market Risk	Likely	Medium	Market Risk is low due to agricultural diversification intensified towards fruits and vegetables production
Physical risk (Weather, diseases, etc.)	Likely	Medium effective decisions to be taken, farmers must have all the necessary information regarding technical data	Physical risk (weather, diseases) is moderate in vegetable production constrained by pests and diseases which effects are exacerbated by climate change and variability

Source: Project team elaboration (2020).

III.6. Sustainability plan

The permaculture principles based on mimicking the patterns and adaptive nature of an ecosystem. Permaculture brings together elements of tried and tested approaches and technologies to the design and development of sustainable systems (Holmgren, 2002). The principle of this concept is a framework that works toward sustainability of livelihoods farming systems. The main benefits of permaculture were identified as improved farmers livelihoods, human health, increased resilience to environmental changes, and reduction of input costs. It maximizes the use of local resources, applying ecological principles to meet human needs for food, shelter, energy, and a sense of community. Permaculture integration with other forms of sustainable agricultural practices can contribute to improved rural livelihoods. It emphasizes sustainable and regenerative agriculture practices and seeks to sustain both people and nature. To be sustainable, there is an emphasis on low input strategies that implementers can replicate using their own resources, without the need for outside funding. Farmer can have a great positive impact by performing the various agricultural operations that make the agricultural environment more suitable for the growth and development of permaculture techniques, or through the intervention of improved varieties with high productivity, good quality and disease resistance.

Running this permaculture business is all about forming a vision, a good understanding of this farming concept, creatively utilizing dryland resources, financial planning and entrepreneurship. Permaculture farming is especially hard because it requires both entrepreneurial skills and all the hard-physical work involved specially in this arid environment. Therefore, to have the business sustainable, here are some key elements to be considered:

- Having a good design and install working landscapes: Planning is critical
- Keeping the expenses low and having a savings buffer
- Starting with a basic business plan in which including a simple marketing strategy

- Investing in knowledge and skills linked to this technique and building partnership with other farmers, organizations, private sector, etc.

V. CONCLUDING REMARKS AND IMPLICATIONS

Evidenced climate change threats, water scarcity, and resources degradations are the main factors that have exacerbated the agropastoral systems problems. They will continue to do so until more sustainable responses are in place. Solving these problems will require an integrated approach that encompasses the main themes of this volume. These include managing productive resources throughout the climate change threats, understanding ways to promote change, and managing dryland resources. There is considerable accumulated experience on options to help tackle these problems.

Permaculture can be effective in supporting multiple objectives in the agropastoral farming systems. As revealed in this study, permaculture could be a promising concept that may help support livelihood activities and improve the ability of agropastoral farmers to deal with environmental problems (land degradation, water scarcity, climate change, etc.) in the dryland areas. The study suggests also that permaculture holds the key to increasing dietary diversity within households and enhancing social and ecological resilience.

The elaboration of a business model for permaculture farming system in a selected household in *Al Majidyya village* (Jordan) reveal the potential profitability of investing in this technique in the dry land areas. Both economic and financial indicators (BCR, IRR, NPV, etc.) support the profitability of this business. This implies a transition from conventional production system in agropastoral towards an array of sustainable regenerative production systems that improve productivity with limited resources. Furthermore, shifting from the current approach in agricultural management in these farming systems is necessary. An approach that acknowledges the role of people as not mere producers of food, but also as managers of ecological systems that produce a suite of ecosystem services is needed. However, as with a specific agricultural system (i.e., agropastoral farming system), the permaculture has its limitations. While permaculture on its own may not match the yields produced through conventional techniques, the prudent path towards reforming the agropastoral food system will require holistic approaches that must be eco-friendly to preserve the environment, coping with climate change threats, ensuring that economically are viable business, and sustainable.

Although this is the first attempt to assess this concept in the Jordanian agropastoral system, we can assure that findings from this study are valuable for Jordanian decision-makers in their roles to promote the permaculture business in the dryland areas. However, these findings, perhaps a necessary step to argue on the profitability evidence that permaculture could be a sustainable solution to both protect the environment and ensure food security for farmers in these areas, there is need to ensure that these improved methods are tailored to suit the agropastoral ecosystems through more research for development (R4D).

A necessary step for this will require institutional support that favours management of dryland productive resources in the frame of the climate change threats by understanding ways to promote change, ensuring smooth transitions across all stages of food systems, which includes improving the resilience of agropastoral communities' livelihoods. With a considerable accumulated experience on options to help tackle these problems (i.e., permaculture), a space for knowledge exchange on sustainable agricultural practices, coupled with a supporting environment and strong governance are also vital. This entails a strong emphasis on alternative agricultural practices in national strategies. Finally, increasing allocated funds to support research and development for such transitions model will be required from community to national levels in order to advance socio-economic development in these less favorited areas.

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Personal information including Name, Business Title, Email, Phones, Images and GPS points included in this report have been authorized in writing or verbally by the data subject.

VII. REFERENCES

Creswell, J.W., Klassen, A.C., Plano Clark, V.L., Smith, K.C. 2011. Best Practices for Mixed Methods Research in the Health Sciences; National Institutes of Health: Bethesda, MD, USA. Accessed on November 2020 at: https://obssr.od.nih.gov/wp-content/uploads/2016/02/Best_Practices_for_Mixed_Methods_Research.pdf.

Didarali, Z., Gambiza, J. 2019. Permaculture: Challenges and Benefits in Improving Rural Livelihoods in South Africa and Zimbabwe. Sustainability 2019, 11. 2219. https://doi.org/10.3390/su11082219.

Holmgren, D. 2002. Permaculture: Principles and Pathways Beyond Sustainability. Holmgren Design Services, Victoria, Australia. Accessed on December 2020 at : https://store.holmgren.com.au/product/principles-and-pathways/.

Strohmeier, S, Fukai, S, Haddad, M, Al Nsour, M, Mudabber, M., Akimoto, K., Yamamoto, S., Evett, S., Oweis, T. 2021. Rehabilitation of degraded rangelands in Jordan: The effects of mechanized micro water harvesting on hill-slope scale soil water and vegetation dynamics. Journal of Arid Environments. 185. https://doi.org/10.1016/j.jaridenv.2020.104338.

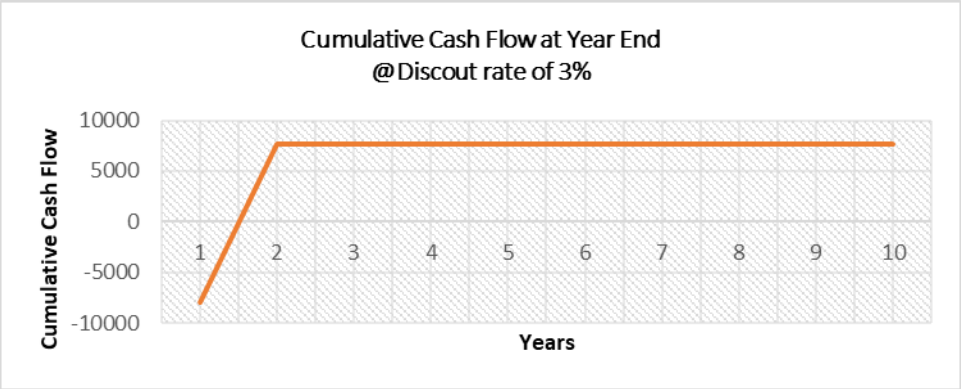
Web-links

https://www.permaculture.co.uk/what-is-permaculture
https://www.thespruce.com/how-to-start-a-permaculture-garden-4050110
https://www.permaculture.co.uk/articles/what-permaculture-part-3-design
https://permacultureapprentice.com/the-ultimate-guide-to-starting-a-profitable-permaculture-farm/
https://www.academia.edu/23765853/Developing_a_Business_Plan_for_a_Permaculture_Design_Consultancy
http://digilib.k.utb.cz/bitstream/handle/10563/45061/zich%C3%A1%C4%8Dkov%C3%A1_2019_dp.pdf?isAllowed=y&sequence=1
https://ovcsupport.org/resource/permaculture-design-for-orphans-and-vulnerable-children-programming-low-cost-sustainable-solutions-for-food-and-nutrition-insecure-communities/

ANNEXES

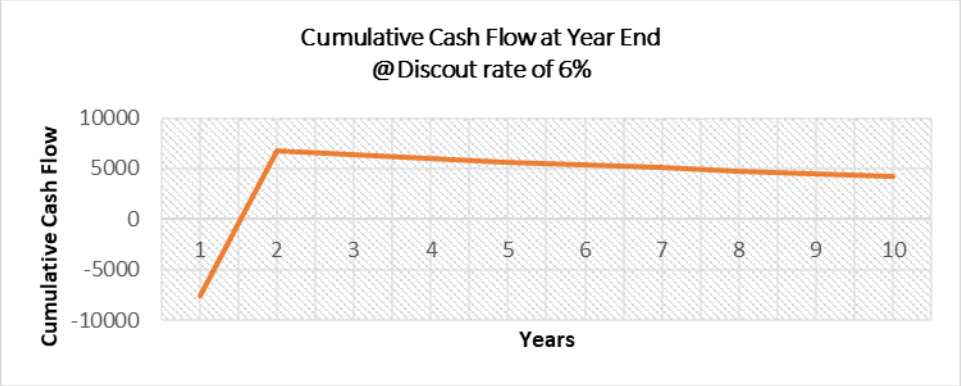
Annex I

Figure A.1. Breakeven point and cumulative cash flow @3% discount rate



Source: Project team elaboration based on Amman market price (2020).

Figure A.2. Breakeven point and cumulative cash flow @6% discount rate



Source: Project team elaboration based on Amman market price (2020).