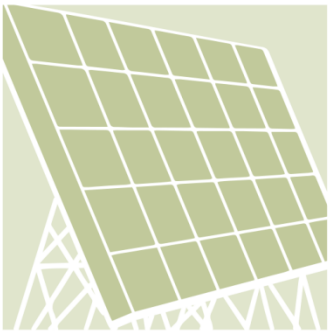
POWERING AGRICULTURE:

AN ENERGY GRAND CHALLENGE FOR DEVELOPMENT

TOOLBOX ON SOLAR POWERED IRRIGATION SYSTEMS (SPIS)



Module 4: Invest

Food and Agriculture Organization of the United Nations

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DUKE ENERGY

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Download
https://energypedia.info/wiki/Toolbox_on_SPIS

About
Powering Agriculture: An Energy Grand Challenge for Development: https://poweringag.org

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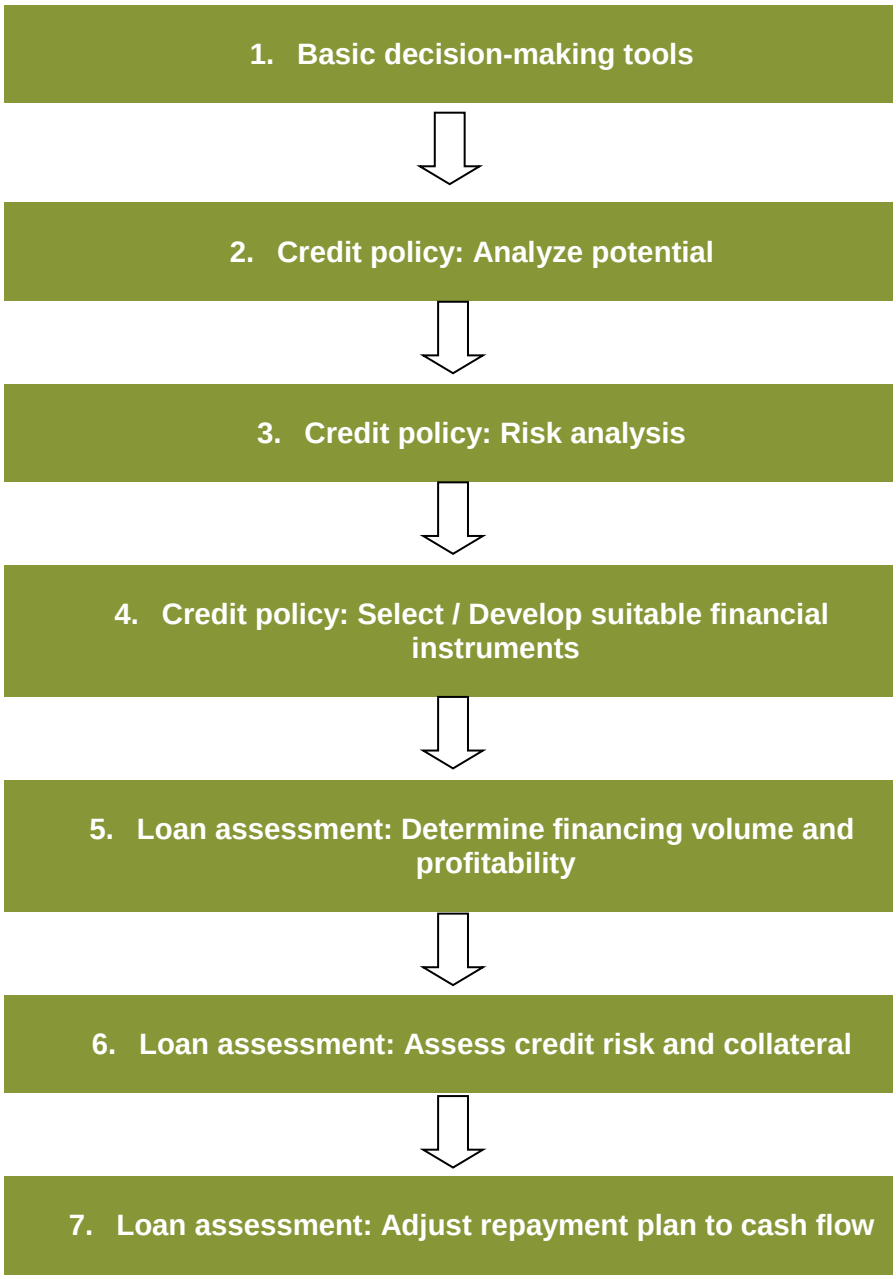
ABBREVIATIONS

Ah	Ampere hour
CWR	Crop Water Requirement
DC/AC	Direct Current / Alternating Current
ET	Evapotranspiration
FAO	Food and Agriculture Organization of the United Nations
Gd	Daily Global Irradiation
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GIWR	Gross Irrigation Water Requirement
GPFI	Global Partnership for Financial Inclusion
HERA	GIZ Program Poverty-Oriented Basic Energy Services
H_T	Total Head
IEC	International Electrotechnical Commission
IFC	International Finance Corporation
IRR	Internal Rate of Return
IWR	Irrigation Water Requirement
MPPT	Maximum Power Point Tracking
NGO	Non-Governmental Organization
NIWR	Net Irrigation Water Requirement
NPV	Net Present Value
m^2	square meter
PV	Photovoltaic
PVP	Photovoltaic Pump
SAT	Side Acceptance Test
SPIS	Solar Powered Irrigation System
STC	Standard Test Conditions
TC	Temperature Coefficient
UV	Ultraviolet
Vd	Daily crop water requirement
W	Watt
Wp	Watt peak

INVEST


1. Basic decision-making tools
2. Credit policy: Analyze potential
3. Credit policy: Risk analysis
4. Credit policy: Select / Develop suitable financial instruments
5. Loan assessment: Determine financing volume and profitability
6. Loan assessment: Assess credit risk and collateral
7. Loan assessment: Adjust repayment plan to cash flow

MODULE AIM & ORIENTATION

Financing solar-powered irrigation can be an opportunity for financial institutions seeking to diversify their loan portfolio and expanding their range of financial products. The **INVEST** module focuses on the product features for SPIS loans, considering direct financing by financial institution to a small and medium-scale agricultural end borrower. The module also brings out the difference of financing solar powered irrigation systems as compared to conventional irrigation systems. It provides guidance to financial service providers who are already financing or planning to finance SPIS. It thus addresses two groups:

1. **Stakeholders at management level** who decide upon credit policies of a financial service provider.
2. **Loan officers** who assess single loan applications for financing SPIS.

PROCESS STEPS

Three steps have been elaborated in the **INVEST** module to support the process of defining the financial service provider's credit policy at the **management level**: Firstly, the analysis of the potential of the SPIS market segment; secondly, the determination of general credit risks involved; and thirdly, the design and test of the suitable financial instruments.

For the specific individual loan assessment process on **loan operations level**, three main steps have been elaborated: Firstly, the determination of the financing volume and calculation of the profitability of the investment; secondly, the assessment of credit risk and collateral of the potential borrower; and finally, determination of the cash flow and the repayment plan for the single potential borrower, along with loan conditions.

1. BASIC DECISION-MAKING TOOLS

An investment decision usually requires an assessment of whether the investment is feasible. This due diligence process will minimize the risk of losing any funds committed to the investment. In essence, this means: if I invest my capital, will I increase my capital, or at the very least avoid losing my capital?

A solar powered irrigation system (SPIS) is generally a long-term investment choice to reduce farm operating expenses or increase agricultural productivity or both. This requires an understanding of the farm enterprise, as a business, in terms of all costs and incomes. The **INVEST – Farm Analysis Tool**, contained in this Toolbox on SPIS, allows for conducting an assessment on farm profitability. It provides entry sheets for adding various farm expenses and incomes and automatically calculates the farm profit margin. It also highlights which fixed and variable costs are most prominent and where savings could have a significant impact. The tool generates a Farm Income Statement, which can be presented to a lending institution.

The tool is useful for:

- Determining the current level of profitability (pre-investment base line)
- Determining the anticipated profitability of the investment (post-investment projection)

Even when the profitability of the farming enterprise is confirmed, this does not automatically imply that an investment into an SPIS is the most sensible choice. This is especially true if other pumping technologies are readily available on the market. A Diesel or Grid-connected electric pump might be more feasible where water pumping is only required for a limited time per year. The **INVEST – Payback Tool** considers and compares solar powered irrigation system (SPIS) with other pumping technologies. Basic data is collected from technology suppliers and the payback period against the farm profit and the different technologies is automatically calculated.

OUTCOME / PRODUCT

- Assessing pre-investment and post-investment profitability;
- Determining most financially viable pumping technology option.

DATA REQUIREMENTS

- Current farm expenditure and income;
- Projected farm income and expenditure;
- Capital costs (capex) for different pumping technologies;
- Operating expenses (opex) for different pumping technologies
- Interest rates from lending institutions
- Inflation and fuel increase rates

PEOPLE / STAKEHOLDERS

- Financial service providers;
- Associations of producers / potential borrowers;
- Technology providers.

IMPORTANT ISSUES

- An annual re-evaluation of farm profitability allows for monitoring improvements, recognizing risks timely and identifying future investment opportunities.

2. CREDIT POLICY: ANALYZE POTENTIAL

Today, solar-powered irrigation is a technically mature and reliable option and an alternative to conventional irrigation approaches. When analyzing options for the development of credit policies for SPIS, the following aspects should be considered:

SPIS is likely to be a feasible option in a region if:

- energy provision for farming is a constraint (availability or cost of fuel, reliability of grid connection);
- an intensification of agricultural production is envisaged;
- producers are market-oriented and not working on subsistence level;
- producers are at least medium sized or organized in small holder groups;
- subsidized refinancing options for financial operators are available;
- grant schemes or subsidies are available to borrowers (producer);
- producers aim at specialized markets using environmental friendly technology (focusing on ecological production, which could give scope for premium pricing);
- technology distributors and system integrators are available in the region;
- water is available and managed adequately so as to prevent ground water depletion in the long run

However, compared to conventional pumping and irrigation methods, PV-based pumping solutions have:

- a comparatively high initial capital investment requirement;
- longer repayment periods or/and significantly higher repayment rates in case of single user; for a community based model, the payback period is reduced
- higher credit risk.

OUTCOME / PRODUCT

- Study on potential of financing SPIS and recommendations for financial service provider.

DATA REQUIREMENTS

- Profile of end customers (cropping patterns, irrigation techniques, pumping systems, other available pumping alternatives, market);
- Current loan products available for potential SPIS customer;
- Water and energy provision regime in region;
- Support/advice structures and subsidy schemes (refinancing) available for the region;
- Environmental impact assessment (long term perspective).

PEOPLE / STAKEHOLDERS

- Management of financial service providers;
- Market analysts/consultants;
- Research and training institutions;
- Public entities promoting and/or subsidizing SPIS initiatives;
- Donors refinancing solar-powered initiatives;
- Associations of producers / potential borrowers;
- Technology and service providers

IMPORTANT ISSUES

- Solar-powered irrigation technology is mature, reliable and systems costs have decreased.

- SPIS generally require higher investment than other irrigation systems, but operational costs are lower.

3. CREDIT POLICY: RISK ANALYSIS

Every SPIS demands a specific solution with changing cropping pattern and the use of a comparatively newer technology like solar.

Therefore, there are no standard “off the shelf” solutions, and hence a thorough loan analysis is an important step, especially when starting with this loan type.

Typical **financial advantages** when changing to solar powered irrigation could be:

- Higher profitability when introducing high value crops;
- Lower and more stable energy costs due to change in energy source (no transport costs or fuel/lubricant supply risks);
- Environment friendly technology (avoid water losses, use of water saving technology, prevent diesel pollution, etc.) can give access to subsidized funds or grants.

SPIS, being based on agricultural activities, follow specific liquidity patterns, such as:

- Irregularity, seasonality;
- Farming-household mix;
- Several cash generating activities;
- System risks (climate, weather, pest, disease, prices).

This requires specific agri-lending tools. Thereby the following risks should be considered:

Financial Risks

- High initial capital investment leads to longer repayment periods and higher interest rates for potential borrowers and thus higher credit risks compared to alternative sources. Other specific risks associated with agriculture.

Technology Risks (see the following modules **DESIGN**, **SET-UP**, **MAINTAIN** for further details).

- High value cropping and water saving irrigation technology is needed;
- Pumps have to be “oversized” in order to meet peak water demands;
- Management capacities to handle the technology should be available;
- Daily operating hours are limited leading to low asset utilization if not operated properly;
- Suitability of location for SPIS;
- Construction risk;
- Overuse of water threatens long term cultivation as well as the environment.

Framework Risks

- Since water is available at very low cost, long term availability of water and good groundwater management is indispensable; (see **SAFEGUARD WATER** module)
- People issues leading to delay in disbursal of subsidy, reluctance to lend or adopt solar pump technology etc.
- Theft or misuse.

OUTCOME / PRODUCT

- Credit risk policy considering the profile of the potential borrowers and adequate portfolio management.

DATA REQUIREMENTS

- Specifics to agri-lending liquidity patterns of borrowers;

- Asset structure of borrowers (potential for collateral), especially land;
- Cropping patterns and profitability of crop types (alternative markets and water availability);
- Organization & management reliability (see **MAINTAIN** module);
- Technology risks (see **DESIGN** module);
- Refinancing options for the region

PEOPLE / STAKEHOLDERS

- Management of financial service providers;
- Public entities promoting or/and subsidizing SPIS initiatives;
- Associations of producers / potential borrowers;
- Market analysts/consultants;
- Technology providers;
- Service providers;
- Research and training institutions (e.g. environmental agency).

IMPORTANT ISSUES

- Consider SPIS specific risks with respect to their long term financing requirements, technological implications (cf. **DESIGN** module), environmental impact (cf. **SAFEGUARD WATER** module) and framework conditions.
- Assume manifold SPIS settings - there is no “off the shelf” loan analysis.
- Generally, minimizing risks can often lead to high(er) transaction costs (except in a community based system) for all parties involved, compared to conventional pumping systems.

SPIS in India

(Source: Lennart Woltering)

4. CREDIT POLICY: SELECT/DEVELOP SUITABLE FINANCIAL INSTRUMENTS

When selecting or developing a loan product for SPIS it is important to ask the following questions:

- **Who?** Market oriented producers, no subsistence production, producer groups possible;
- **What?** Finance for energy source and pumping system used for irrigation; energy and/or water saving technology;
- **How much?** Establish range of loan sum; % own-contribution of producer; % subsidy;
- **When?** Range of loan period (years); repayment frequency (months); disbursement in tranches;
- **Interest rate?** From ..x..% p.a. to ..x..% p.a. (range);
- **Collateral?** Equipment (Solar Pumpset), mortgages, additional collateral (guarantee scheme), non-traditional collateral (future harvest, warehouse), leasing scheme with equipment providers.

Loan products for financing SPIS usually:

- have higher initial investment sums with consequently longer repayment periods and/or high installment rates;
- need alternative guarantee schemes / unconventional collateral;
- have higher interest rate payments due to higher credit risk and long investment period;
- focus on innovative and progressive borrowers, investing in high(er) value crops;
- should be strictly oriented towards water capacity available and the farm's specific requirements;
- use no blueprint; every farm / enterprise is unique

In order to **prevent prohibitive loan transaction costs**, consider:

- guarantee funds with public support or insurance;
- leasing schemes with pumping system providers and others;
- group financing approaches for producer groups;
- public subsidies and sponsoring;
- favorable refinancing options for the financial institutions (e.g. subsidized interest rates offered by donors/public entities).

In order to **overcome the information gap** in respect of the new technology, introduce additional activities such as:

- Encouraging (potential) clients to get informed and consult technical advice through site visits and case studies of existing installations
- Training and sensitization of loan staff on basics about the technology;
- Monitoring loan performance closely;
- Continuous dialogue with solar pump suppliers

Note: SPIS clients could become future clients for other financial products (cross selling).

Automated irrigation system in Morocco – largely subsidized by the state

(Source: Lennart Woltering)

OUTCOME / PRODUCT

- **Guidelines and Procedures** including assessment and decision guidelines, target key performance indicators (KPIs).

DATA REQUIREMENTS

- Comparable clients liquidity pattern in current agricultural portfolio.

Compute, prepare

- repayment plan (with varying interest rates, repayment periods and repayment frequencies);
- profitability margins by crops and farm sizes;
- tables for evaluating types of collateral;
- list of eligible crops;
- list of eligible irrigation systems and average investment cost per component;
- list of eligible SPIS configurations and average investment cost per component (see **DESIGN** and **GET INFORMED**;
- list of eligible types of collateral

PEOPLE / STAKEHOLDERS

- Management of financial service providers;
- Experienced credit staff (senior, agri-finance);
- Associations of producers / potential borrowers;
- Agricultural extension services;
- Research and training institutes (e.g. environmental agencies);
- Providers of service, technology and inputs

IMPORTANT ISSUES

- Prevent prohibitive transaction costs for borrowers;
- Overcome information gap of financial operators;
- Note that standardization potential is limited
- Select capable loan staff for this segment with corresponding background and experience (provide training if required)

5. LOAN ASSESSMENT: DETERMINE FINANCING VOLUME AND PROFITABILITY

While the previous process steps focused on the policy makers, the next steps focus on the loan officers who assess single loan applications for financing SPIS.

Loan officers generally prefer to use the tools provided by their institution, but it is useful to use the tools **INVEST – Farm Analysis Tool** and **INVEST – Payback Tool** as they are specifically designed for SPIS and can provide an first estimation of viability. In fact these tools can be provided to borrowers/loan applicants to verify their own assumptions.

Note: Transaction costs for loan review can be high, especially if the technology has limited scope for standardization. Using specific tools, and encouraging loan applicants to use the same, can minimize unnecessary effort.

OUTCOME / PRODUCT

- Profitability analysis of investment (and alternatives);
- Cash flow analysis;
- Financial projections on investment costs (CAPEX) (and alternatives)

PEOPLE / STAKEHOLDER

- Loan officers financing or planning to finance SPIS;
- Producer(s) / potential borrower(s);
- Management of financial service providers (operational level);
- Agricultural extension services and promotion agencies (e.g. for subsidies);
- Providers of service, technology and inputs;
- Research and training institutes

DATA REQUIREMENTS

Research, collect, analyze, cross-check

- prices for components to be financed;
- cropping pattern and crop prices (fluctuation, trends etc.);
- prices for O&M costs and inputs (including other options);
- sales revenues
- purpose and sums provided as subsidies and/or through sponsors;
- macro-economic variables (inflation, interest rates, etc.);
- tax policies (corporate income tax, GST/VAT dynamics, etc.)

Compute, prepare

- water unit cost;
- annual revenue and operating expenses (OPEX) --> Annual gross margin of production (current and future);
- CAPEX (capital expenditure); i.e. total/annual sum for financing investment in SPIS (and alternative system);
- cash flow projections (current, future, alternative energy source);
- life cycle cost of SPIS investment;
- Payback Period (PP), Net Present Value (NPV) and Internal Rate of Return (IRR) of SPIS investment.

IMPORTANT ISSUES

- Compare PV with alternative pumping solutions with the same scenarios and consider varying profitability of different SPIS systems (crops, size).
- Loan should be assessed by informed, trained and capable loan staff

6. LOAN ASSESSMENT: ASSESS CREDIT RISK AND COLLATERAL

Apart from “normal” credit risks applying to agricultural loans, such as variations related to external shocks and an irregular cash flow based on seasonality, financing SPIS brings additional challenges. These are mainly related to technological risks or risks in respect to operation and maintenance. Also, high initial investment costs increase the overall financial risk. Finally oversizing of the pumping system can be an issue.

When **valuing assets for collateral**, the view should be broadened by considering the whole farm as well as the overall family situation, and not only specifically the planned investment. The borrower should be encouraged to contribute with own capital and alternative collateral should be accepted by the financial operator. Panels of the solar powered irrigation systems can be used as collateral, if there is a market for second hand panels.

Since solar power is considered an **environmental friendly technology, given that water is used adequately** (**SAFEGUARD WATER** module), there is a scope for external public or donor funded guarantee schemes and subsidies from where producers can get access to finance. These opportunities should be actively explored and assessed.

OUTCOME / PRODUCT

- Family/farm balance sheet;
- Total value of collateral and/or types of guarantees;
- General risk analysis;

DATA REQUIREMENTS

Research, collect, analyze

- market for respective crops, inputs, etc.;
- availability of risk guarantee options / opportunities or insurance.

Compute, prepare

- valuation of farm (and family) assets and liabilities;
- revenue earned through agriculture production and other additional income generating activities, if any
- borrower’s own (capital) contribution;
- revenue of collateral and/or guarantee schemes;
- assessment of technology and O&M risk (**DESIGN**, **SET UP**, **MAINTAIN**).

PEOPLE / STAKEHOLDERS

- Loan officers financing or planning to finance SPIS;
- Producer(s) / potential borrower(s);
- Management of Financial Service Providers (operational level);
- Public entities promoting and/or subsidizing SPIS initiatives;
- Sponsors.

IMPORTANT ISSUES

- Look for alternative types of collateral (e.g. guarantee schemes) and assess if PV panels could be a guarantee
- Minimize risk of theft or damage of the collateral (e.g. fencing of panels, guards, insurance)
- Minimize associated costs

7. LOAN ASSESSMENT: ADJUST REPAYMENT PLAN TO CASH FLOW

SPIS, being based on agricultural activities, follows **specific liquidity patterns**, such as:

- irregularity, seasonality;
- farming-household mix;
- several cash generating activities (agricultural, non-agricultural);
- external shocks (climate, weather, pest, disease, prices).

Determining specific loan features (disbursement pattern, repayment rate, collateral, repayment frequency) should be based on cash flow projections of a particular case.

This requires:

- in depth understanding of the farm and family economics;
- strong interaction with the potential borrower;
- networking with other sources of information in the sector and region;
- thorough understanding of the market and market trends;
- trained staff with innovative attitudes.

SPIS requires **high initial investment**. These may result in:

- long repayment periods (5-10 years);
- a need for high profitability of the SPIS;
- a need for a grace period at the beginning of the repayment plan.

Note: High installments resulting from very short loan repayment periods can create a threatening liquidity shortage – especially in the first year.

OUTCOME / PRODUCT

- Cash flow statement (current, projected);
- Tailor-made disbursement and repayment plan;
- Financial risk analysis/adjustment;
- Summarized risk analysis;
- Tailor-made loan details for decision

DATA REQUIREMENTS

Collect, compute, prepare:

- total farm liquidity analysis (both current and that projected with SPIS);
- borrower's own capital contribution;
- repayment potential;
- repayment plan;
- loan details
- subsidy/ re-finance details

PEOPLE / STAKEHOLDERS

- Loan officers financing or planning to finance SPIS;
- Producer(s) / potential borrower;
- Management of financial service providers (operational level);
- Public entities promoting and/or subsidizing SPIS;
- Sponsors

IMPORTANT ISSUES

- Specific liquidity patterns need to be identified for every single case
- Data collection process is challenging due to intermingled family-farm economy
- High initial investment should ideally not lead to prohibitive transaction costs (consider bank loans or external subsidies);

- High initial investment should ideally not lead to liquidity shortage for the borrower (be flexible when defining installment plans)

0.5 ha solar powered drip irrigation system used by a woman's group in rural Northern Benin for production of lettuce and other vegetables.

(Source: Lennart Woltering)

FURTHER READING, LINKS AND TOOLS

Links

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Tools

- **INVEST – Farm Analysis Tool**: to calculate the overall profitability of the farm enterprise and to determine the extent of variable and fixed costs.
- **INVEST – Payback Tool**: to calculate the financial viability of SPIS and to compare that to other alternative pumping systems (diesel and grid connected systems)

Other relevant tools:

- **PROMOTE – SPIS Rapid Assessment**: includes a (financial) market analysis for financing of SPIS components

FINANCIAL GLOSSARY

Assets	Position in balance sheet which represents what a company owns.
Capital expenditures (CAPEX)	Are one-time expenses. Normally they are long-term investments in non-consumable parts of the business, for example money that is spent on pump, panels, machines, etc.
Cash Inflows	All cash receipts realized within a given period (e.g. from sales).
Cash Flow	Is the incoming and outgoing cash of a business. Cash outflows are considered as negative cash flows and cash inflows as positive ones.
Cash Outflow	Outgoing cash, all cash payments realized during a given period (e.g. for buying production inputs, loan installments, buying equipment).
Creditors	Payable occurring from past credit (money owed to suppliers for expenses).
Collateral	Property or other assets that a borrower offers a lender to secure a loan.
Credit Sales	Sales made without receiving cash.
Current Assets	Cash and other assets which are expected to be converted into cash or consumed during the normal operating cycle of a business.
Debtors	Receivables occurring from past credit sales.
Depreciation	A cost charged against fixed assets for their replacement. Note: “depreciation” is one of the few expenses for which there is no associated outgoing cash flow
Expenses / expenditure	Payment of cash or cash equivalent for good or services received. Cost of resources used up or consumed by the activities of the business.
Finished Good Stock	An inventory of final products ready for sale.
Financial Viability	Ability to generate sufficient income to meet operating expenditure, financing needs and, ideally, to allow profit generation. Financial viability is usually assessed using Net Present Value (NPV) and Internal Rate of Return (IRR) approaches together with estimating the sensitivity of the cost and revenue elements. Both NPV and IRR are the most commonly used decision criteria of a cost-benefit analysis.
Fixed Assets	Assets required for long-term use and for physical use in the business (machinery, buildings, office equipment, cars, etc.).
Fixed Cost	Costs that do not vary with the level of production.
Fixed Investment	Investment made in fixed assets (e.g. machinery).
Gross Margin	Gross income minus gross expenses.

Income	Income is money generated from the activities of the business.
Inflation	The rate at which the general level of prices for goods and services is rising and, consequently, the purchasing power of currency is falling.
Internal Rate of Return	Gives the discount rate over the life-span of a capital investment; i.e. the profit rate generated by a certain investment (amount) over its life-span. By calculating IRR of a project you can answer the question whether the money is well spent or if less risky investment alternatives might be more profitable in the long run, e.g. putting the money on a bank account to get interest on it.
Liabilities	Claims by creditors against the assets of a business.
Life Cycle Costing	Is a technique for evaluating total cost of ownership to compare different alternatives.
Material Stocks	An inventory of all raw materials not yet used in production.
Net Present Value	Determines the present worth of an investment by discounting the cash inflows and cash outflows generated by this investment over its life span. For the determination of the NPV you need to define the expected life span of the investment as well as a discount factor, which might be near to the interest rate on deposits. You could also use the NPV for comparison of alternative investment options.
Net Working Capital	Current Assets minus Current Liabilities.
Operating expenses (OPEX)	Are the ongoing costs for running a business that are related with the operation and maintenance. They are the expenses related to the production activity of the business and they are divided into fixed and variable costs.
Payback Period (PP)	Is the length of time required to recover the cost of an investment.
Profitability	Income minus expenses. It is stated in the income statement (or Profit and Loss Statement), which reports a company‘s revenue, expenses, and net income over a period of time.
Raw Material Purchases	Cost incurred on purchase of raw material.
Revenue	Is the income earned by a business typically through selling goods/products or services.
Variable Cost	Cost that varies directly with the level of production delivered.

ANNEX – COLLECTION OF FORMULAE (FINANCES)

AVERAGE CASH FLOW*

**Definition: The "cash flow" is the incoming and outgoing cash of a business. Expenses (costs) are considered as negative cash flows and revenues as positive ones.*

Formula: *(Revenue-R –Operating Expenses-C) = Cf. = Cash flow*

PAYBACK PERIOD* (PP)

**Definition: The payback period is the length of time required to recover the cost of an investment.*

Formula: I/(R-C) = PP = Payback Period

I=Initial investment (CAPEX)

C=Average annual operating expenses (OPEX), excluding depreciation

R=Average annual revenue

(R-C) = Cf. = Cash flow

NET PRESENT VALUE* (NPV)

**Definition: The "Net Present Value" or NPV determines the present worth of an investment by discounting the cash inflows and cash outflows generated by this investment over its life span. For the determination of the NPV you need to define the expected life span of the investment as well as a discount factor, which might be near to the interest rate on deposits. You could also use the NPV for comparison of alternative investment options.*

Formula:

$$NPV = \sum_{t=1}^{n} \frac{Cf_t}{(1+r)^t} - I_0 + S$$

r= Discount factor

S= Salvage Value

I= Initial investment cost

t= years counting from base year

n= lifetime of project (panels)

INTERNAL RATE OF RETURN* (IRR)

**Definition: The "Internal Rate of Return" or IRR gives the discount rate over the life-span of a capital investment; i.e. the profit rate generated by a certain investment (amount) over its life-span. By calculating IRR of a project you can answer the question whether the money is well spent or if less risky investment alternatives might be more profitable in the long run, e.g. putting the money on a bank account to get interest on it.*

Formula:

$$NPV = 0, \text{ or}$$

$$\sum_{t=1}^{n} \frac{Cf_t}{(1+IRR)^t} - I_0 + S = 0$$

C_f = Net Cash Inflow

I_0 = Initial Capital Investment

t = time period in years