Climate risk management opportunities

Input supplies

Value chain interventions/ outcomes	Climate risk issues	Climate risk management opportunities
Seeds	High-yield varieties may perform poorly under higher temperatures, humidity, salinity; certain hybrid seed varieties degrade soils over the long term	Provide access to specific climate-adapted varieties where available (e.g. heat-tolerant, submergence- tolerant); maintain diversity through seed banks, including wild relatives (CGIAR, 2013); test different seeds under different conditions
Fertilizers	Generally positive in low-input systems, but may increase inter-annual variability in yields; trade- offs with emissions	Integrate fertilizer advice and supply with wider soil management (FAO, 2013, Module 4); precision farming
Animal feed and breeds	Feed quality helps emissions reductions, but larger better-fed animals may be more exposed to climate-related water stress	Evaluate heat tolerance, housing and feed requirements of proposed livestock (FAO, 2013, Module 8)
Pest management	Possible increases in pests and diseases for crops (e.g. maize stem borer, tomato flies, cassava mealy bug) and livestock (e.g. cattle ticks)	Promote integrated pest management (e.g. push-pull methods [Minja 2006]); develop monitoring, knowledge and applied research systems for pests and diseases of crops, livestock and fisheries
Information services	Advance climate information enables better decisions about the timing of planting, input application and harvesting, and the choice of varieties, labour inputs and planting or grazing locations	Enable provision of seasonal and near-term forecasts in formats usable and accessible by farmers (Tall, 2013); strengthen early warning systems; invest in country-level capacity in scaled down climate impact modelling (WCRP, 2013; CCAFS, 2013) and scenario planning
Financial services	Lack of upfront capital may be a major drawback for farmers to adopt climate-resilient practices	Investigate financial channels to reduce risks associated with innovation (e.g. microfinance, small grants programmes, index-based weather insurance (WFP and IFAD, 2011)
Tools and equipment	Possible damage of tools and equipment (e.g. water tanks, irrigation canals, pumps, generators, vehicles, seed storage) from extreme weather events	Substitute low-cost high-efficiency systems wherever possible (e.g. rainwater harvesting plus surface water irrigation); provide access to early warning systems; introduce protective features to the siting and storage of seeds, tools, vehicles, fuels and energy infrastructure
Others		

Climate risk management opportunities

Agricultural production

Value chain interventions/ outcomes	Climate risk issues	Climate risk management opportunities
Soil management	Rising temperatures, greater soil moisture evaporation and more destructive interplay between dry spells and intensive rainfall events increase soil erosion and reduce soil organic content	Introduce measures to counter soil erosion (e.g. terracing, contour bunds, drainage, agroforestry, perennial crops); increase soil carbon and improve the management of soil organic matter; rehabilitate degraded lands
Water management	Greater crop evapotranspiration; loss of soil water; changes in amount and timing of rainfall; more variable river run-off; reduced groundwater recharge; changes in sea level; salinity intrusions into soil and groundwater	Adopt water conservation and efficiency measures such as water harvesting, efficient irrigation infrastructure, check dams, flood management and drainage; support riparian habitat restoration; undertake hydrological and salinity monitoring; introduce water allocation systems
On-farm energy	Mechanization using fossil fuels causes emissions increases; use of fuelwood can cause deforestation and erosion	Undertake trade-offs analysis (FAO, 2011; FAO, 2013, Module 5); introduce renewable energy sources (e.g. solar energy for heating, cooling, drying and pumping, small wind turbines, biogas digesters)
Diversification	Monoculture crops are more prone to catastrophic losses from climate extremes than diversified systems	Investigate potential for sustainable intensification and diversified cropping systems through crop rotations (e.g. staple/horticulture), intercropping, agroforestry, mixed crop/livestock systems (FAO, 2013, Module 6)
Livestock	Declining pasture productivity; increasing livestock mortality from heat stress; loss of productive pasture from erosion; damage to livestock infrastructure; declining fodder quality	Introduce mixed crop/livestock farming systems; support pasture restoration; diversify livestock breeds; improve rangeland management; make livestock infrastructure more climate resilient; increase production efficiency (FAO, 2013, Module 8)
Fisheries and aquaculture	Changing salinity conditions in natural reservoirs; shifting fish stocks due to higher water temperatures; migratory shifts of biodiversity	Improve production efficiency and feed management; diversify aquaculture; introduce mixed crop/aquaculture or aquaculture/livestock systems; introduce mixed fish/crop/forest systems
Production infrastructure	Value chain-related production facilities in certain locations (including fields, greenhouses, livestock facilities) face greater exposure to floods, wildfires, high wind speeds	Include physical risk management structures at farm- level (e.g. windbreaks, flood control dykes, firebreaks); retrofit or relocate sensitive infrastructure; create buffer zones (e.g. wetlands, greenbelts, flood recession schemes)
Landscape-leve management	Positive value chain outcomes (e.g. higher incomes) may incentivize greater land clearance and unsustainable water use, affecting local microclimate and hydrology and compounding climate hazards	Undertake participatory mapping and land-use planning; remote sensing-based landscape monitoring; exploit all available incentives (financial, regulatory, etc.) for sustainable environmental management
Skills base of farmers and local institutions	Local knowledge and capacity is central to managing production under conditions of rapid change	Invest in local capacity planning, monitoring, decision-making and financial management; transfer control to local institutions; provide training on climate issues and support to farmer-based research and knowledge; include smallholders in policy dialogue and scenario-building exercises
Others		

Climate risk management opportunities

Post-production: storage, processing, transport, and retail

Value chain interventions/ outcomes	Climate risk issues	Climate risk management opportunities
Post-harvest management	Rising losses in harvest volume; declining safety, market quality and nutritional value due to increasing temperatures, humidity, pests, and diseases	Incentivize waste reduction measures and value addition for by-products (FAO, 2013, Module 11); provide renewable energy sources to cover changing requirements for cooling, drying, milling, and threshing
Siting of processing facilities	Extreme climate events (such as floods, heatwaves, storms) may damage processing facilities; shifting climatic conditions may render some sites redundant or increase transport costs	Use hazard exposure and crop suitability maps to inform siting of processing facilities; retrofit processing facilities with protective features; insure processing facilities against extreme climate events
Energy in processing	High dependence on local bioenergy (wood, charcoal, dung, crop residues) has trade-offs with better soil management; rising temperatures require more energy for cooling	Provide renewable energy sources (such as solar photovoltaic panels for cooling/drying/milling/heating, wind, biogas); equip processing facilities with energy- saving appliances (e.g. solar lighting, solar charging, efficient cook stoves); adopt pollution control measures
Water in processing	Declining and more irregular water supplies; growing competition with other domestic or industrial users	Re-site facilities; increase water storage and distribution capacity (water harvesting, communal ponds, groundwater recharge); introduce demand-side water efficiency measures; support conflict resolution for different water users (e.g. water user groups)
Packaging materials and methods	Rising temperatures and humidity may increase or decrease post- harvest losses and waste, as well as impact food safety	Design suitable packaging materials in parallel with waste and storage management strategies
Processing infrastructure	Buildings and roads exposed to higher peak rainfall, winds, and heat stress	Introduce protective features and reinforcements into the design of critical infrastructure to handle higher maximum water run-off and higher temperatures; improve ventilation in buildings; harvest surplus water and energy from rooftops and appliances; use early warning systems
Transport hubs and routes	Routes may become seasonally or permanently impassable (or open); extreme events will disrupt logistics	Re-site hubs; develop contingency plans for road, rail, water and air transport; co-design value addition, storage and transport components to avoid high-risk transport routes and seasons; upgrade docks, jetties, roads, railways
Refrigeration and cold chains	Temperature rises increase requirements for and costs of refrigeration; rising energy requirements increase greenhouse gas emissions	Conduct cost-benefit analyses of dependency on refrigerated cold chains; introduce renewable energy sources for cooling and ventilation; optimize storage and transport management
"Just-in-time" logistics	Extreme climate events (floods, storms, heatwaves) can make it impossible to comply with "just-in- time" requirements	Develop contingency plans for climate shocks and extreme events; create contingency storage opportunities; link into regional markets to avoid over- dependence on high-value export markets
Demand from retail and consumers	Shifts in quantity requirements and seasonality with climatic trends; disruptions in demand with climate variability; hence higher price fluctuations	Assess market risks and opportunities before value chain implementation, including likely climatic impacts on high-value markets; strengthen and diversify storage to buffer price fluctuations; diversify into "off- season" crops
Commodity labelling and certification	Higher awareness of consumers about climate change creates new markets for sustainably produced and processed commodities with a low carbon footprint	Explore opportunities of sustainable procurement, green labelling, and certification (IIED, 2013)
Others		