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AI 3019

SUSTAINABLE AGRICULTURE AND FOOD SECURITY

Prepared by JESHWIN GIFTSON SP AP/AGRI

UNIT V

POLICES AND PROGRAMMES FOR SUSTAINABLE AGRICULTURE AND FOOD SECURITY

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5.6 Definition of Virtual Water:

Virtual Water refers to the hidden or indirect water used in the production and processing of agricultural, industrial, and consumer products. It accounts for the total water consumed at various stages of the supply chain, including growing, manufacturing, and transporting goods.

History of Virtual Water Concept:

The concept of virtual water was introduced by **Professor John Anthony Allan** in the early 1990s. His work focused on the Middle East and North Africa (MENA) region, which faced acute water scarcity. He demonstrated that these regions could mitigate their water deficits by **importing water-intensive crops** rather than producing them domestically — a concept known as **"virtual water trade."**

Q Key Milestones:

- **1993:** John Allan introduced the term "virtual water," emphasizing the importance of accounting for hidden water flows in global trade.
- 2003: The concept gained recognition when Allan received the Stockholm Water Prize for his contributions.
- **2008-Present:** Virtual water and water footprint assessments have become central to international water resource management and sustainable development policies.

Solution Virtual Water Trade: Concept and Importance

Obstantion

Virtual Water Trade (VWT) refers to the international transfer of virtual water embedded in traded goods, particularly agricultural products. Countries that are water-scarce import water-intensive commodities, while water-rich countries export them.

•• How Virtual Water Trade Works:

- Water-Scarce Countries: Import crops and goods that require large amounts of water, conserving their own limited water resources.
- Water-Abundant Countries: Export agricultural and industrial products with high water requirements, utilizing their surplus water for economic gain.

(F Example:

- Egypt, a water-scarce country, imports wheat from countries like the USA and Canada, effectively "importing" virtual water.
- The USA, with a surplus of water resources, exports corn and soybeans to other nations, indirectly "exporting" virtual water.

Types of Virtual Water:

- 1. **Green Water:** Rainwater stored in the soil and used by plants. It is essential for rainfed agriculture.
- 2. **Blue Water:** Surface and groundwater resources used for irrigation, industrial processes, and domestic use.
- 3. **Grey Water:** Water required to dilute pollutants generated during production, ensuring that the water meets quality standards.

Trends in Virtual Water Trade:

• Major Exporters:

- USA, Brazil, Australia, Canada, and India are major exporters of virtual water through agricultural commodities.
- Major Importers:
 - China, Japan, Middle Eastern countries, and European nations are the largest importers of virtual water due to their high food demand and limited water availability.

Statistics on Virtual Water Trade:

- Approximately **1,600 billion cubic meters (BCM)** of water are traded annually across the globe through virtual water.
- Around **70%** of virtual water trade involves agricultural commodities, followed by industrial goods.
- The Middle East and North Africa (MENA) region imports over **50%** of its food, making it one of the largest importers of virtual water.

Significance of Virtual Water in Global Trade:

1. Water Resource Management:

- Helps alleviate water stress in arid and semi-arid regions.
- Promotes more efficient global water use through specialization and trade.

2. Food Security:

 Countries with limited water resources can ensure food security by importing water-intensive crops.

3. Economic Efficiency:

 Encourages countries to focus on producing goods in which they have a comparative advantage in terms of water availability.

4. Environmental Sustainability:

- Reduces pressure on overexploited local water resources.
- Minimizes water footprints of water-scarce nations.

Virtual Water and Direct Water: Examples and Differences

Water for Pasta

To make a bowl of pasta, water is required to boil the dry pasta in the pot – this is direct water use for the person eating that pasta at home. In order to produce the pasta, water is required at many steps along the value chain, and when the water used at those steps is added up, it makes up virtual water content for that pasta. Some of these steps include: water to grow the wheat; water to produce the fuel for machines to harvest the wheat and transport the pasta to the store;

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and water to create the electricity for processing the wheat into flour and pasta. (Learn more about **Food's Big Water Footprint**.)

Water for Jackets

When a person wears a nylon jacket to the point where it gets dirty, water is required to clean it in a washing machine – this is direct water use for person who wore the jacket. In order to produce the jacket, water is required at many steps along the value chain, and when the water used at those steps is added together, it makes up virtual water content for that jacket. Some of these steps include: water to drill, produce and refine the oil and natural gas that makes nylon; water to make the electricity for manufacturing the jacket; and water to produce the fuel that moves vehicles and transports the jacket to the store.

Need for Virtual Water and Trade: Why It Matters?

C 1. Alleviating Water Scarcity

- Many countries, especially those in arid and semi-arid regions, face **severe water scarcity** due to limited freshwater availability.
- Virtual Water Trade allows these nations to import water-intensive products (like cereals and meat) rather than producing them domestically, thereby conserving their local water resources.

(F Example:

• The Middle East and North Africa (MENA) region imports over **50% of its food** due to limited water resources, reducing pressure on local aquifers.

2. Enhancing Food Security

- Countries with insufficient water resources often struggle to grow enough food to meet their population's needs.
- Virtual water trade ensures a **steady supply of food and agricultural commodities**, contributing to food security and reducing the risk of hunger.

Example:

• Egypt imports large quantities of wheat from countries like Russia and the USA, saving millions of cubic meters of water while ensuring food security for its growing population.

• 3. Efficient Global Water Use

- Virtual water trade promotes **comparative advantage** by encouraging water-rich countries to grow and export water-intensive crops, while water-scarce countries focus on less water-demanding activities.
- This **global redistribution of water resources** ensures more efficient use of water at a planetary scale.

Example:

• Brazil and the USA, with abundant water resources, export soybeans and corn to countries like China and Japan, where water availability is limited.

4. Mitigating Climate Change Impact

- As climate change intensifies, unpredictable rainfall, droughts, and floods threaten agriculture in many parts of the world.
- Virtual water trade acts as a **buffer against climate-induced agricultural failures** by enabling countries to import essential goods when domestic production falls short.

Example:

• African nations facing droughts increasingly rely on virtual water imports of grains to prevent food shortages.

§ 5. Reducing Pressure on Local Water Resources

- In water-stressed regions, overexploitation of groundwater and surface water for agriculture can lead to depletion and long-term environmental degradation.
- Virtual water trade **reduces the need for excessive irrigation**, conserving fragile ecosystems and preventing desertification.

Example:

• Saudi Arabia reduced its domestic wheat production in the 2000s to conserve its groundwater reserves and started importing wheat, thus **saving its depleting aquifers.**

₩ 6. Supporting Industrial and Economic Growth

- Countries can allocate limited water resources to **higher-value industrial and urban uses** instead of exhausting them on water-intensive agriculture.
- This enables nations to focus on **economic growth and diversification** by importing water-intensive products.

Example:

• China, with limited freshwater per capita, focuses on industrial growth while importing water-intensive commodities such as soybeans and meat.

□ 7. Promoting Sustainable Agriculture

- Virtual water trade encourages **sustainable agricultural practices** by shifting waterintensive agriculture to regions where it is more sustainable and less environmentally damaging.
- This minimizes the adverse environmental impact caused by overexploitation of water resources.

Example:

• Australia and Canada, with ample water resources, export grains to countries that struggle with water scarcity, reducing the environmental burden on water-stressed regions.

- Virtual water trade strengthens **global economic ties** by fostering interdependence between water-rich and water-scarce countries.
- This interdependence promotes **peace**, **stability**, **and cooperation** by ensuring that countries rely on each other for essential resources.

(F Example:

• The European Union (EU) engages in virtual water trade by importing fruits and vegetables from water-rich countries, fostering economic cooperation with trading partners.

59. Reducing Water Footprint and Promoting Sustainability

- By engaging in virtual water trade, countries can effectively **reduce their national water footprint** and work towards achieving sustainable development goals (SDGs), particularly:
 - **SDG 6:** Clean Water and Sanitation
 - SDG 2: Zero Hunger
 - **SDG 12:** Responsible Consumption and Production

10. Strategic Resource Management

- Virtual water trade acts as a **strategic tool** for countries to manage their water resources effectively by balancing domestic production and imports.
- Nations can make informed decisions about allocating their limited water resources to high-priority sectors while **outsourcing water-intensive production**.

Example:

• India, facing growing water stress in regions like Punjab and Haryana, could consider reducing rice and wheat cultivation and importing these crops to conserve groundwater.

Challenges If Virtual Water Trade Is Ignored:

- **Overexploitation of Local Water Resources:** Leads to depletion of groundwater and degradation of ecosystems.
- **Food Insecurity:** Without imports, water-scarce nations may face difficulties meeting their food demands.
- **Increased Vulnerability to Climate Shocks:** Countries without diversified supply chains may suffer during climate-induced disruptions.

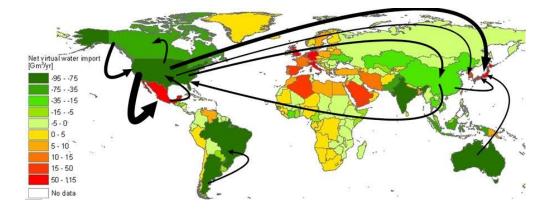


Fig 5.6 Virtual Water Trade

5.7 Sustainable food Security Action Plan

A **Sustainable Food Security Action Plan (SFSAP)** is a comprehensive strategy developed to ensure long-term food security by addressing both immediate food needs and the root causes of food insecurity. The aim is to create a resilient, equitable, and sustainable food system that

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meets the nutritional needs of current and future populations without compromising the ability of future generations to meet their own food needs.

Key Components of a Sustainable Food Security Action Plan:

1. Assessment of Current Food Security Status:

- Data Collection: Understanding the current state of food security in a region or country is essential. This includes analyzing the availability of food, access to food, stability of food sources, and the utilization of food (including nutritional value).
- **Vulnerable Groups**: Identify groups that are most at risk of food insecurity (e.g., children, elderly, low-income families, marginalized communities, and people living in disaster-prone areas).
- Food Systems Analysis: Assess the local food systems, including production, distribution, processing, and consumption patterns, to identify weaknesses, gaps, and opportunities for improvement.

2. Improving Food Production Systems:

- Sustainable Agricultural Practices: Promote practices that increase food production while preserving the environment. These include crop rotation, agroforestry, organic farming, conservation tillage, and the use of droughtresistant crops.
- Support for Smallholder Farmers: Small-scale farmers play a critical role in food security. Providing them with access to resources such as seeds, technology, training, and financial services can improve their productivity and resilience.
- **Diversification of Food Sources**: Encourage a diversified agricultural system that includes both plant-based and animal-based products, as well as aquaculture and alternative proteins. This reduces dependence on a single food source and enhances resilience to climate change and market fluctuations.
- **Climate-Smart Agriculture**: Integrating climate-resilient practices to protect food production from climate change impacts, such as unpredictable weather patterns, droughts, and floods.
- 3. Strengthening Food Access:

- **Economic Access**: Address the root causes of poverty by creating opportunities for income generation, social safety nets, and access to affordable food.
- **Food Distribution Networks**: Improve infrastructure such as roads, transportation, and storage facilities to reduce food loss and improve market access, especially in rural areas.
- Affordability: Work towards ensuring that nutritious food is affordable for all segments of society, especially vulnerable populations. This could involve price regulation, subsidies, or direct assistance.
- **Improved Nutrition and Diets**: Enhance awareness and education programs to ensure that people not only have access to food but also the knowledge to make nutritious and healthy food choices.

4. Enhancing Food Utilization and Nutrition:

- **Nutritional Education**: Promote education about balanced diets, proper food preparation, and safe handling to prevent foodborne illnesses.
- **Fortification and Biofortification**: Incorporating micronutrients into staple foods through fortification or biofortification can help address deficiencies in key vitamins and minerals, such as iron, vitamin A, and iodine.
- Water, Sanitation, and Hygiene: Ensure that people have access to clean water and sanitation facilities, as waterborne diseases can undermine food security and nutrition.

5. Social Protection and Safety Nets:

- **Emergency Food Aid**: Establish systems for the rapid distribution of food during times of crisis (e.g., natural disasters, conflict, or economic shocks).
- Long-term Support: Social protection programs like cash transfers, food vouchers, and subsidized food can provide a buffer against food insecurity, especially for vulnerable households.
- Community-Based Support Systems: Strengthen community organizations and networks that can respond to food security needs locally, such as food banks, community kitchens, and local cooperatives.

6. Promoting Resilient Food Systems:

• **Disaster Risk Reduction**: Develop early warning systems and disaster response strategies that help protect food production and distribution systems from environmental and man-made disasters.

- Diversified Livelihoods: Promote income diversification for rural and urban communities, including non-agricultural activities such as small-scale enterprises, crafts, and services.
- Strengthening Local Food Systems: Empower local communities to produce, process, and consume locally grown foods. This reduces reliance on imports and strengthens local economies.

7. Climate Change Adaptation and Mitigation:

- Adaptation Strategies: Implement policies that help farmers and food producers adapt to changing climatic conditions, including water management, drought-resistant crops, and better land management.
- **Mitigation**: Develop strategies to reduce greenhouse gas emissions from agriculture, such as promoting agroecology, reducing food waste, and shifting to plant-based diets.

8. Governance, Policy, and Institutional Strengthening:

- Policy Frameworks: Establish clear, long-term policies that align with international food security frameworks like the UN Sustainable Development Goals (SDGs), particularly Goal 2: Zero Hunger.
- Collaboration: Foster collaboration between governments, NGOs, private sector, and local communities to develop comprehensive and integrated approaches to food security.
- Monitoring and Accountability: Create a monitoring and evaluation system to track progress, assess the effectiveness of interventions, and make necessary adjustments to the action plan.

9. International Cooperation and Trade:

- **Global Partnerships**: Engage in international cooperation, including trade agreements, knowledge exchange, and humanitarian assistance, to improve food security on a global scale.
- **Trade Policies**: Ensure that international trade policies support food security by reducing trade barriers, improving market access, and promoting fair trade practices.

10. Sustainability and Long-Term Impact:

• **Resource Conservation**: Promote the sustainable use of natural resources (e.g., soil, water, biodiversity) to ensure food security for future generations.

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• **Integrated Systems Approach**: Adopt a systems-thinking approach that integrates food security with broader development goals, such as poverty reduction, health, education, and environmental sustainability.



Fig 5.7 Sustainable food Security Action Plan