### **Problem Statement for the Hackathon**

**Title:***Design a Modular, Versatile, Frugal, Small-Scale Agricultural Machine for Cash Crop Cultivation in Nepal.*

**Problem Overview:**Farmers in Nepal face numerous challenges in increasing productivity and efficiency due to diverse terrains, varying soil conditions, manual labour dependence, and limited access to affordable and adaptable tools. These challenges are particularly acute for small-scale farmers cultivating cash crops, as existing machinery is often expensive, crop-specific, or unsuitable for the unique conditions in Nepal.

There is a need for an innovative mechanical solution that can address these challenges by supporting **multiple farming operations** in a **cost-effective and adaptable manner.**

**Objective:**Design a **versatile**, **small-scale**, **modular** mechanical machine that aids in the cultivation of cash crops in Nepal. The machine must effectively operate in both **dry and wet mud** conditions and be adaptable to different crop types. Participants must know Crop Nature and Cultivation Styles while developing the versatile machine, The solution should prioritize **frugal innovation**, allowing for affordable local manufacturing and ease of use, and **modular design** for interchangeable tools or components for adapting to various crops. The mechanism should be designed to allow for future **automation** if needed.

### **Key Definitions**

1. **Cash Crops:**Cash crops are grown primarily for commercial purposes rather than direct consumption. In Nepal, key cash crops (e.g., sugarcane, coffee, tea, cotton, jute, or spices).
2. **Small-Scale:**A compact, lightweight machine that can be easily used on small and medium-sized farms. It should be operable by individual farmers or small groups without requiring large storage space or specialized transport.
3. **Modular:**The machine must have interchangeable components or attachments designed to adapt to various **cash crops** (e.g., sugarcane, tea, coffee, cotton, jute, spices). The design should allow farmers to easily switch between crop-specific configurations without needing a new machine. The focus is on supporting **different crops**, not multiple farming tasks like cultivation and harvesting.
4. **Mechanism:**The core design must include a system that effectively performs the necessary farming tasks for a variety of **cash crops** (e.g., planting, seeding, and supporting growth). The mechanism should be flexible and adaptable for different plant types, ensuring it can be used for a range of crops. While the system may initially rely on manual or motor-driven operations, it should be designed in a way that can later be automated (e.g., through the addition of motors or sensors). The focus is on creating a reliable and adaptable mechanism that serves multiple crop types efficiently.
5. **Dry and Wet Mud Compatibility:**The machine must function effectively in both dry soil and muddy, waterlogged conditions. This may involve adaptable wheels/tracks, adjustable tilling depth, or self-cleaning features to prevent clogging.
6. **Frugal Innovation:**The solution should be affordable, use locally available materials, and be manufactured with existing campus or local workshops. Maintenance should be simple, with easily replaceable parts.

### **Expected Features**

* **Multi-functionality:** Ability to perform multiple farming tasks with interchangeable modules.
* **Adaptability:** Operates smoothly in both dry and wet soil conditions.
* **Affordability:** Low production and maintenance costs using local resources.
* **Ease of Use:** Simple controls suitable for farmers with minimal technical expertise.
* **Scalability:** Base design can be enhanced with automation features in the future.

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**Guidelines for Participants**

1. **Design Considerations:**
   * Prioritize **modularity**: Design attachments or components that can handle planting tasks for multiple cash crops.
   * Ensure ergonomic design for user comfort, such as proper handle placement and weight distribution.
   * Address the functionality of even small details like attachment connections, movement smoothness, and part durability.
2. **CAD Proficiency:**
   * Use CAD tools like **SolidWorks**, **Fusion 360**, or **FreeCAD** to create accurate 3D models.
   * Verify all dimensions and tolerances to ensure precise assembly and smooth operation.
   * Include detailed models for **attachments, joints, and modular components**.
3. **Functionality Testing:**
   * Simulate the design in CAD software to check for motion and functionality issues.
   * Verify that all modular components can be easily swapped or reconfigured without specialized tools.
   * Account for real-world farming conditions, such as different soil types or crop sizes.
4. **Documentation:**
   * Include **exploded views** of the design to illustrate the assembly process.
   * Provide a simple **user guide** covering operation, maintenance, and instructions for using different modules.
5. **Frugal Mechanism Checklist:**
   * Does the design reduce the farmer's effort and time compared to manual methods?
   * Is it simple to operate and maintain without requiring extensive technical knowledge?
   * Can it adapt to different crops or tasks with ease?

References:

1. [Agriculture Old](https://www.fncci.org/agriculture-148.html) (for crash crops)
2. [The making of a frugal innovation ecosystem: A case from North-East India](https://www.researchgate.net/profile/Bibhuti-Bhattacharjya/publication/353164045_The_making_of_a_frugal_innovation_ecosystem_A_case_from_North-East_India/links/60ea8788b8c0d5588ceb27f8/The-making-of-a-frugal-innovation-ecosystem-A-case-from-North-East-India.pdf) (Frugal Innovation)