MEMORANDUM OF UNDERSTANDING

BETWEEN

NANAJI DESHMUKH KRUSHI SANJEEVANI PRAKALP, GOVERNMENT OF MAHARASHTRA

AND

INDIAN INSTITUTE OF TECHNOLOGY, BOMBAY

For

WATER AND ENERGY MODELLING FOR IDENTIFICATION OF CONSTRAINTS, DEVELOPMENT OF SOLUTIONS, ADVISORIES AND EXTENSION PROGRAMS, FOR PROTECTING SMALL-HOLDER FARMERS

This Memorandum of Understanding is being entered into at Mumbai on <mark>2nd of May 2023</mark> hereinafter called 'MoU'.

BETWEEN

Nanaji Deshmukh Krushi Sanjeevani Prakalp (NDKSP), Government of Maharashtra represented by Project Director (hereinafter referred to as **'First Party'**) having its office located at 30B, Arcade, World Trade Centre, Cuffe Parade, Mumbai- 400005 which term and expression shall mean and include, unless repugnant to the context, its successors, assignees, administrators of the First Party

AND

Indian Institute of Technology, Bombay (hereinafter referred to as **'Second Party'**), represented by Dean, Research and Development, IIT Bombay, having its registered office at Powai, Mumbai 400076 which term and expression shall mean and include, unless repugnant to the context, its successors, assignees, administrators of the Second Party

1.0   Source of Funding: The First Party will receive financing from the World Bank which will be used for this MoU and the First Party wishes to have the Second Party perform the services hereinafter referred to, and WHEREAS, the Second Party is willing to perform these services

2.0   Preamble:

The Government of Maharashtra (GoM) is implementing the World Bank aided project on climate resilient agriculture (PoCRA) also named Nanaji Deshmukh Krushi Sanjeevani Prakalp (NDKSP). The project development objective is to enhance climate-resilience and profitability of smallholder farming systems in project districts of Maharashtra. The project aims to achieve the objective through promotion of climate resilient technologies and commodity value chain across approximately 5,000 drought-prone villages in 15 districts, namely, Jalgaon, Aurangabad, Jalna, Beed, Parbhani, Hingoli, Osmanabad, Latur, Nanded, Buldhana, Washim, Akola, Amravati, Yavatmal, and Wardha and approximately 1000 salinity affected villages in the basin of Purna river spread across Akola, Amravati, Buldhana and Jalgaon districts.

Since August 2018, IIT Bombay (IITB) has been contributing as a technical and knowledge partner to PoCRA through four MoUs. The sectors covered have increased from water to energy and post-harvest technologies. This is the fifth MoU between the project of Government of Maharashtra and IITB and covers specific resilience enabling activities in water and energy for agriculture.

Contribution in water sector
Water forms a basic input for the farmer and is central to the problem of resilience. The core objective of the partnership between IIT Bombay and PoCRA has been to develop a GIS-based scientific planning framework based on water-budget in order to:

Increase aggregate water availability at village/cluster level → Ensure access to water at farm-level → Stabilize yields → Improve income and profitability

The achievements of the past engagement may be broadly stated as follows:

- Development and deployment of "On-demand real-time hourly computation model" of water budget for 3.2 million grid-points (200mx200m) for 32 crops during monsoon season in the whole PoCRA region including non PoCRA villages, thus almost covering 18,000+ villages.
- Aggregation of the water budget results to any region of interest - zone, village, cluster, catchment and so on – currently village water budgets are published and displayed in all the PoCRA villages
- Estimation of key biophysical quantities such as soil moisture, crop stress, surface runoff, GW recharge at any hour and day during the ongoing monsoon, and estimation of water availability at the start of rabi season for each village (including non PoCRA villages) in the PoCRA districts.
- Development of an IT stack and Dashboard which provides up-to-date information on climate, crop and soil conditions across the PoCRA districts at a fine grid.

The water-budget framework not only gives water-budget results as numbers and charts, but also enables:

- vulnerability mapping and targeting of beneficiaries at the village level
- advisories for dry spells, wet spells and other kharif contingencies
- better, more effective and spatial planning of natural resource management interventions
- demand-side planning through rabi crop-plans and GW-use-plans as required by the GW Act 2013

Thus, this water budget model helps to translate the actual problems faced by the farmers into quantifiable indicators and parameters which help to devise actionable plans at the farmer and village level.

In the last two years, special attention was also given to extension of water balance concepts and resilience at the village and community level. Various innovative extension strategies (for example, the focus on median yields and storage capacity within a village (in mm), village-level kharif season planning meeting (*hangam baithak*) as a platform to discuss water and energy issues etc.) have been formulated and demonstrated in pilot villages to bring climate-resilience to the forefront of the community discourse.

Regarding the soundness of the model, it has been achieved, to a large extent, over the last five years, through continuous engagements and interactions with PMU, experts, external agencies (such as NBSS, GSDA, SAUs) and through validation of the model through on-field measurements and farmer experiences.

Such a scientifically sound water budget computation framework can also be immediately scaled up to all the non PoCRA villages in the 15 PoCRA districts. The hydrological and the computational framework is so designed that and it can also be easily extended and adapted to newer geographies and to the whole state through inclusion of local soil, crop, terrain and hydrogeological parameters, incorporation of new local biophysical phenomena, corresponding changes to the model and through on-field validation.

Contributions in the energy sector:

Access to electricity is crucial for reliable access to irrigation and is a key constraint along with water in crop-planning. In the first two years of engagement, it was pointed out through field-work that supply of electricity, its quality and schedule of power, energy are important aspects in strengthening farmers against unreliable rainfall and increasing crop demands. Consequently, the Energy component was included in MoU III.

Extensive field as well as analytical work in the agricultural-energy sector over the past 2.5 years has resulted into:
- A prototype framework for proposal of optimization of energy infrastructure at village-level through restructuring of LT networks
- A framework to estimate energy usage and infrastructure requirements based on cropping and irrigation practices. The parameters used in the framework have been obtained through extensive water and energy usage measurements, as well as surveys and field observations of irrigation practices.

- Extension work for building farmers awareness of use of capacitors, appropriate pump selection and load management
- Pilot Load management initiative at the Distribution Transformer level and a preliminary app to illustrate schedules and communicate to farmers.
- Cropping pattern-based Irrigation and Investment indices to indicate the investments in private irrigation infrastructure

Thus, through the PoCRA project, a robust and foundational knowledge infrastructure for climate resilience in agriculture has been designed and developed over the past few years in the water and energy sectors.

Going ahead:

While much has been achieved, there are some points which still remain to be addressed. Although the water budget charts have been displayed in all the PoCRA villages, the knowledge and planning frameworks have yet not fully percolated down to the district administration and further down to the village and community level. The ground-level state extension agents still face a huge task of taking the model results and advisories to the community and individual farmers.

Thus, in order to make the villages truly climate resilient, there is a need for a systematic planning and extension workflow at the district and local levels to disseminate the benefits of the knowledge and data infrastructure down to the village and community level.

Keeping this in mind, during MoU V, the IITB team plans to focus mainly on strengthening the transformative and planning capacity of the district agriculture office to analyze, design and deliver climate, water, soil, crop and energy related advisories and water-budget based planning frameworks down to the community and farmers through district extension services and agents.

This would require working closely with the district extension agencies i.e. District Superintendent Agriculture Office (DSAO), the sub-district and taluka level offices and most importantly with the Agriculture Assistants at the village-level to see that the knowledge products generated in the PMU reach effectively to the village and the community. For this, the IITB team plans to focus on two pilot districts and work with the District Superintendent Agriculture Office as well as with the Agriculture Assistants in a few selected villages during the fifth MoU.

This will help to introduce new and improved Standard Operating Procedures (SoPs) at the district level, and provide required knowledge support to the DSAO to prepare and maintain village-level climate, soil, crop and water database, prepare district contingency plans, identify and target vulnerable regions in the district, respond to extreme climate events on a real-time basis, prepare more evidence-based district annual plans (to be presented in the District Planning Committee meetings) and so on.

This will also help to pave the way for achieving the following important objectives of the PoCRA project as per the Project Appraisal Document (Feb 2018) (*pg 61, para 37 under Component C*):

● to safeguard the sustainability of the project interventions beyond project lifetime and
● to promote spill‑over impacts to villages and districts not covered by PoCRA
● to mainstream climate‑resilience in the agenda of institutions supporting agricultural growth and rural development in Maharashtra.
● to promote and pursue a more climate‑resilient agriculture, with sector strategies and policies based on strong analytical underpinnings and cutting‑edge climate, water and crop modeling

The key output of this engagement apart from other deliverables will be a policy brief for handing over the key knowledge generation processes and infrastructure at PMU during the PoCRA project to the Department of Agriculture for mainstreaming and enhancing climate resilience in agriculture based on the experience and learnings in the two selected districts.

A more detailed account of the planned activities for MoU V appears below.

3.0   Objective and Scope of the Assignment:

Water

The core objectives of the proposed engagement with PoCRA in MoU V are:

● To assist PMU in identifying, designing and coding advisories based on water-budget model results and key existing datasets such as real-time weather, soil and so on, and deciding effective mechanisms for dissemination of these advisories to farmers / village
● To work with the District Superintendent Agriculture Officer (DSAO) in order to establish the climate-resilience vulnerability and response framework and ensure effective dissemination of water budget results, climate, soil, energy advisories from the PMU / Department of Agriculture to the district level and further down to the village level
● To strengthen the district extension pipeline i.e. the sub-district offices and especially the village-level Agriculture Assistants through intensive on-field hand-holding, trainings, workshops and design of simple and effective formats and Standard Operating Procedures (SoPs) for dissemination of water budget results, advisories etc. from the district office to the community and facilitate more informed, scientific and collective decision making at the village level through conduct of *hangam baithaks*
● To refine, fine-tune and integrate the rabi planning module into the water budget framework and demonstrate its use and utility in community crop planning during the rabi *hangam baithaks*
● To further improve and strengthen the water budget computational framework by incorporating improved input datasets such as soil layers, crop properties etc. and provide IT support to PMU for changes in the existing procedures (such as MLP workflow and app changes, design of water budget charts etc.), and for mainstreaming and handing them over to the Department of Agriculture.

- To integrate the village supply-side and demand-side data for the last few years and to compute and analyze trends of kharif and rabi indices

This engagement will help to transfer the water-budget planning framework from the PMU to the district offices and will help setting up a framework and guidelines for mainstreaming it not only the PoCRA regions, but also the non-PoCRA regions across the state. Thus, an important broad objective is to integrate the water-budget based planning and climate-resilience into the planning frameworks of the Department of Agriculture.

Energy

The work done in MoU III resulted in developments along three aspects: Understanding the current status, supply side solutions, demand side solutions, development of a framework to connect supply and demand. Some of these aspects were taken forward in MoU IV. The development of these results from MoU III to MoU IV is:

<u>Demonstration of current status:</u>
Stress in the network and its contours; The status and reasons for the constraints in getting new agricultural connections (*MoU III)*

<u>Supply side solutions - Restructuring of LT networks:</u>
The proposal of optimization of infrastructure through restructuring of LT networks (*MoU III)*

<u>Matching infrastructure to demand:</u>
Development of framework to estimate energy usage and infrastructure requirement based on cropping and irrigation practices. This included measurements of energy and water usage as well as observations of irrigation practices. (*MoU III*)

Determination of Distribution Transformer loading based on cropping (*MoU III*)

MLP based Energy estimation tool prototype: The framework developed in MoU III was integrated into the IT stack with the village level data collection app to determine Distribution Transformer capacity requirement and shortfall if any. The farmers with metered energy and water usage were monitored in MoU IV also.

<u>Demand side solutions</u>
Extension work, building farmers awareness of use of capacitors, pump selection and load management (*MoU III*)

Pilot Distribution Transformer User Group on select DTs. Load management and capacitor installation was implemented. An app was developed to illustrate schedules and communicate to farmers.

Cropping pattern-based Irrigation and Investment indices were developed for irrigating and non-irrigating farmers. These indicate the investments in private irrigation infrastructure being made by farmers and through government expenditure (subsidies), and the profits as a function of these investments, to aid in policy design.

In **MoU V**, we propose to take forward the community engagement and some demand-side management components developed from MoU III and IV, specifically:

- Capacitor extension work will be done through structured demonstrations in select villages.
- Load management pilot projects were successfully implemented in MoU IV with schedules made by the IIT team. In MoU V, the app will be upgraded to include partially automated schedule creation so as to aid the farmers to work independently. Select DT user groups will be engaged to develop the app functionality, and they will be encouraged to use the app in the rabi season and provide feedback.
- Krishi sahayaks will be trained to use the energy infrastructure requirement from the energy estimation tool to conduct the hangam baithaks, compare with existing infrastructure in the village, discuss DT failure and maintenance status.

Scope

During this MoU, IITB team will focus on two PoCRA districts, one from Vidarbha and one from Marathwada. The Water and Energy teams will work in the same two districts. Apart from working with the DSAO, SDAOs and TAOs, both Water and Energy teams will work very closely and intensively in 5 villages per district each, in order to demonstrate and mainstream the dissemination of the knowledge and information at the community and farmer level through training of AAs, design of guidelines etc.. Out of the 5 villages per district, both Water and Energy teams will select one non-PoCRA village. Also, Water and Energy teams will work together in one village per district to demonstrate the linkages between water and energy.

Thus, in total, IITB team will work in 18 villages in two districts, out of which 8 would be only Water, 8 would be only Energy and 2 would be common. Also, 4 out of 18 selected villages would be non-PoCRA villages. The districts will be selected as per discussion with the PMU team. The villages in the districts will be selected as per logistical convenience, biophysical factors, size of the village and presence of motivated AAs or CAs or VCRMCs and so on.

The IITB team will work at the following levels from PMU / Dept. of Agriculture to community level:

Level	Activities
PMU / Dept. of Agriculture	Maintain and update water and energy IT stacks, host water-budget and energy computational framework backend, identify, design and generate real-time advisories, reports etc, make changes to the model for incorporating improved datasets

DSAO	Design and develop Interface to receive advisories and route them to respective offices, issue instructions for responding to extreme events, Develop mechanism to collate and analyze village-level data on yields, cropping patterns, irrigation and energy infrastructure, NRM status, post-monsoon index etc. and assist DSAO to take evidence-based decisions for targeted interventions
Extension agents	Design training material, hold training workshops for Agriculture Assistants to receive advisories and respond to extreme events, to design survey formats to collect and submit village data such as cropping patterns, yields, NRM storage capacities, DT failures etc., to run and interpret water budgets, to estimate energy demand and supply, to facilitate crop planning, load management, and capacitor usage.
Community	Conduct hangam baithaks, design extension activities with the community such as rain-gauge installation Promote science and evidence based planning for supply-side and demand-side interventions

4.0 Implementation Arrangements: Methodology and Outputs

Methodology and Outputs:

The above broad objectives and motivation are translated into concrete objectives and tasks as follows:

Water

A. Kharif advisory and reporting framework

There are two subcomponents in this component:

A1: Identification, design, generation and dissemination of real-time, location-specific advisories and automated reports based on key datasets such as real-time Mahavedh AWS weather data, IMD forecast, NBSS soil data etc. and water budget results. This includes following tasks:

1. Identification, selection and prioritization of weather, soil-moisture and water-budget based advisories and automated reports to be generated during kharif 2023
2. Assist PMU to identify, design and develop the dissemination mechanism (a report or an SMS or WhatsApp notification, etc.) for each advisory
3. Develop reporting framework, formulate and design advisory triggers, write code, test results, design formats for the advisories and reports selected by PMU as per the prioritization decided

A2: Analysis of FFS data: This is a separate subcomponent where, as per PMU's suggestion,

IITB team, along with the PMU team, will analyze the historical FFS (Farm-Field-School) data to see if any relevant patterns useful to derive trigger-based advisories come up. This includes:

1. Analysis of the historical FFS data to identify possible correlations between weather data, crop stage, crop diseases and pests in order to establish triggering conditions for a few, selected contingencies / pest-occurrences. Collaborate with SAUs and experts at PMU.

B. District climate-resilience vulnerability and response framework

Main objectives are (i) to establish the climate-resilience vulnerability and response framework at the district agriculture office. (ii) To enable vulnerability and response reporting. (iii) To ensure effective dissemination of water budget results, climate, soil, energy advisories from the PMU / Department of Agriculture to the district level and further down to the village level.

Tasks

1) Visit the District Agriculture office and understand the requirements of DSAO with regards to contingency planning for climate resilience, current planning activities and tools, limitations in using PoCRA water budgets etc. Based on the visit, formulate the climate resilient strategic and planning mechanism for DSAO
2) Hold a workshop for the District Superintendent Agriculture Officers of all the 15 PoCRA districts to demonstrate the use-cases of the district-level water budget, its connection with vulnerability and action plan for improving resilience.
3) Design and set up an interface at the DSAO for receiving timely advisories, updates, water budget reports etc. from the PMU / DoA as well as to visualize the primary data collected by the AAs from the villages.
4) IT support to DSAO for the water budget computation and its interpretation during kharif.
5) Planning support to DSAO for designing the extension strategy and dissemination of water budget results and advisories to village level during kharif and post-kharif.
6) Closure of district activities, handover and feasibility report for scaleup of district water budget computational framework to the whole state.

C. District climate resilience extension framework

The key objective is to strengthen the district-level extension pipeline, which consists of DSAO at the district level up to the Agricultural Assistant at the village-level, so as to facilitate communication of advisories, intervention and resilience plans, targeting of beneficiaries and water budget results from district to village and at the same time communication of key information related to village-level water stress, issues and demands from village to district office.

Tasks

(work with the Agriculture Assistants and cluster assistants in the in the selected villages in the selected districts)

1) Hold introductory meetings in selected villages in presence of Sarpanch, VCRMC, Agricultural Assistants (AAs) and Cluster Assistants (CAs) to brief the outline of extension activities to be carried out during kharif and rabi seasons
2) Design training material and survey formats and other material to be used during extension activities
3) Hold training workshops for AAs and CAs at IITB for conduct of surveys, collection of primary data (such as cropping pattern, yields, stress etc.), implementation of water budget calendar, conduct of hangam baithaks etc.
4) Collect baseline data in the selected villages through NRM surveys and farmer interviews along with the AAs and CAs to capture key village level indicators such as yields, access to water, irrigation investments, water stress etc.
5) Work with school students and teachers (through VCRMC and Gram Panchayat) to install rain gauges in the selected villages and hold training sessions in the school for recording, documenting, displaying and interpreting daily rainfall data and its consequences.
6) Conduct rabi hangam baithak in the selected villages to explain the kharif 2023 water budget and present key pointers to probable supply-side and demand-side interventions to the community
7) Prepare village resource book and vulnerability reports which document the village level problems, water budgets, yields, stress, spatial imbalance in water availability, investments, access to water, success stories, failure stories and devise a mechanism to update it every year /season and make it available and accessible to all.
8) Run the annual water budget for the selected villages at the end of the rabi season, prepare new improved charts and display them in the selected villages. Conduct closure meetings and compare the proposed cropping pattern with the actual cropping pattern, discuss probable demand-side interventions with the community

D. Rabi planning framework

Objectives: To facilitate village-level crop planning and diversification based on the water availability and other financial as well as equity constraints

The prototype rabi planning module developed in MoU IV will be refined and revised based on tests and validations conducted on field and will be used during the *rabi hangam baithaks* in the selected villages.

Tasks

1. Conduct focused group discussions in selected villages for documenting key inputs (such as input and operating costs, yield curves, market prices, irrigation practices etc.) required by the rabi planning module and design templates for carrying such surveys by AAs and CAs
2. Conduct on-field tests of the LP (Linear Programming) model and rabi planning module for testing various input scenarios
3. Refine and improve the LP model based on feedback from the field

4. Design interface for the rabi planning module and/or integrate rabi planning module in the MLP for effective community decision-making during rabi hangam baithaks
5. Demonstrate the use of rabi planning module in the selected villages to arrive at an proposed optimal cropping pattern for rabi 2023-24
6. Conduct zone-level meetings in the selected villages to verify the results of the rabi planning module and demonstrate use of water budget results and explain the linkage between biophysical, climatic factors with farmer decisions, irrigation practices, crop choices, competition between farmers etc.

E. **Improvements and refinements to the water budget model**

Tasks
1. Incorporate NBSS and other available improved input datasets in the water budget model, test results and get approved by PMU
2. Minor improvements in code-efficiency, setup of automated scripts and dry run of the real-time water budgets for kharif 2023
3. Prepare zones and prepare water budget scripts for all the non-PoCRA villages in the selected districts.
4. Run Regional Geography (RG) for the selected 10 clusters during kharif 2023
5. Refine Regional Geography (RG) Surface flow module through feedback from the field observations done during kharif 2023
6. Assist PMU in changes to MLP and village water budget charts as proposed during MoU IV

Energy

F. **Structured demonstration of value of capacitors in 10 villages**
A structured demonstration to show the value and workings of capacitors will be done.

Tasks
1. Select One Distribution Transformer (DT) in each of 5 villages of 2 talukas / 2 districts. Convince farmers on the DTs to participate in the demo.
2. Collection of data about DT through farmers surveys, field survey, and measurements, and preparation of report on status of DT.
3. Prepare communication and awareness building material and protocol. Village meetings to share results and show awareness building material. Installation of capacitors.
4. Conduct power factor measurements at DT during rabi. Survey farmers. Get feedback about any issues.
5. At the end of rabi, conduct surveys. Estimate number of pump breakdowns, tripping etc. Prepare material for presentation to the village.
6. Conduct village meetings to present results.

G. **Load Management app upgrade to include scheduling**

The pilot indicated that farmers need help in preparing the schedule. Hence the app is to be upgraded to partially automate schedule preparation.

Tasks
1. Select 6 DTs to get inputs for development of app
2. Design and develop the schedule automation with inputs from these DTs
3. Develop stand-alone app with the following functionality:
   - Partially automate scheduling
   - Allow farmer addition and modifications
   - Assist PMU to integrate app into MLP
4. Test and feedback in rabi from those Distribution Transformers

H. Implementation of Energy estimation tool in 10 villages towards Information, Comprehension, and Collective action

The energy estimation was developed to estimate village level requirements, create awareness of current status and demand side activities, and promote community action. This objective develops the training material , formats and protocols to be followed in the hangam baithaks to incorporate the energy status discussion, feedback, and action. It also includes the process of data collection for the tool by krishi sahayaks to enter into the energy estimation tool, as well as the feedback from the rabi hangam baithak.

Tasks

1. Identify 10 villages for detailed follow-up

2. Develop training material, formats, and protocols for the krishi sahayaks to understand and conduct the Information, Comprehension, and Collective action with regard to energy infrastructure in the village; Design interface for village survey for energy estimation tool, and rabi baithak feedback.

3. Training for krishi sahayaks in 10 villages

4. Validate the internal integrity of data collected by krishi sahayaks in the 10 villages and the output of the energy estimation tool for the same.

5. Energy estimation tool model improvement based on output of 10 villages

6. Integrate learnings into design of input interface for energy estimation tool

7. Support PMU for changes in MLP app for energy estimation tool input and feedback at rabi baithak

8. Observe and get feedback at the rabi hangam baithak in 10 villages

9. Develop checks for quality of data collected in rabi hangam baithak

I. Special component for image-classification-based and AIML-based advisories

The advisories mentioned in the component A (Kharif advisory and reporting framework) are the advisories on which the present IITB Water team and PMU team will work in the months of April and May 2023 and deploy in the upcoming monsoon season, whereas the following two special categories of advisories need more exploration, research and a separate engagement between machine-learning and image-classification experts at IITB and the PMU team. Hence these advisories are placed in a separate component and will be handled by the concerned faculty at the IITB.

This component deals with specific tasks with regards to two different categories of advisories:

a. On-demand, curative advisories based on crop digital libraries and image classification: The main objective behind these advisories is to create a platform where any farmer can take an image of the crop disease or crop pest from a mobile-device, send it to PMU and get back relevant advice related to that pest / disease in close to real-time. This would require three key tasks, viz, (i) preparation or procurement of crop digital library or an image database which consists of a database of images and required description of various insects, pests, diseases at various stages of growth, (ii) development of a mechanism to classify and map the image sent by the farmer to an image in the crop digital library in order to identify the crop disease or pest, (iii) development of expertise to diagnose the problem and prescribe appropriate actions and remedies, translated to codified algorithms which can be automated.
Assuming that (i) and (iii) tasks will be taken care by the PMU team, the key task to be included as part of this component is:

to develop image-classification algorithms for the processing, classification and mapping of the crop-pest or crop-disease images uploaded by the farmer to the ones in the prepared / procured crop digital library for identification of the pest / disease to generate annotation and using it for existing triggers for advisories.

b. Use of AIML to analyze performance of rule-based advisories: Currently, PMU disseminates few rule-based crop advisories for major crops at block level through the crop advisory portal. PMU plans to collect feedback from the farmers with regards to effectiveness of these advisories i.e. did the advisory predict the situation on ground correctly and was the action prescribed by the advisory helpful in addressing the problem. These feedbacks would be used to improve the effectiveness of the advisories in real-time. In order to implement such a mechanism, there would be two key tasks which are included as part of this component:

i. *Create a mechanism to collect and record current rule-based advisories and farmer responses*
ii. *Prepare a training dataset from the positive and negative farmer responses received, and develop machine-learning tools to generate required annotations for improving existing triggers for these advisories*

J. Analysis of water budget indices and trends

The objective here is to integrate the village supply-side and demand-side data for the last few years and to compute and analyze trends of kharif and rabi indices. This will measure supply-side interventions done by the PMU and DoA and demand-side changes at the community level.

This will require following datasets:

(i) Supply-side interventions data - NRM structures along with their storage capacities per village for last four years

(ii) Demand-side data - seasonal cropping pattern per village for last four years

(iii) Individual irrigation-related DBT data - Disbursements made for drip/sprinkler, pipelines (for water transfers), farm ponds, wells etc.

(iv) M & E data - Yields for major kharif, rabi and annual crops, irrigation methods and other panel data for baseline and mid-term surveys.

Tasks:

1) Collection and curation of above input datasets and creation of panel of villages
2) Preparation of inputs, running water budgets with the above input datasets
3) Computation of indices and analysis of trends
4) Final summary report on overall trends

5.0 Reporting Obligations of the second party

COMPOSITION OF REVIEW COMMITTEE TO MONITOR CONSULTANT ACTIVITIES

The review committee from PoCRA PMU will consist as below -

1. **Agronomist**
2. **Hydrologist**
3. **Soil Science Expert**
4. **GIS Expert**
5. **Procurement Specialist**
6. **Agricultural Engineer**
7. **Finance specialist[PJ1]**

Phase	Deliverables	Duration

I	Inception report	Within 15 days from commencement of work
II	**Water:** - Note on kharif advisories to be implemented during Kharif 2023 - Note on changes to the water budget model to incorporate improved input datasets - Preliminary report for setting up climate resilience planning framework at the DSAO *IT / Extension:* - Newer version of water budget model with improved NBSS data and code i.e. queries/triggers for generating reports and advisories - Advisory module-Templates for reports and advisories to be generated based on real-time water budget model results and other datasets for kharif 2023 - First version of interface for on-demand report generation in the 2 selected district offices along with Software Requirements Specification, insights and roadmap for next version **Energy** - Brief report on selection of DT for capacitors scale-up - Brief report on selection of DTs for load management app development - Brief report on - villages selected for energy ICC - Preliminary training material developed for ICC **(I) Special advisory component** - Brief note on Terms of Reference for this component - Preliminary report on Image-Classification-based and AIML-based advisories and approach / methodology to be followed **(J) Analysis of water budget indices and trends** - Preliminary report on curation of input datasets, creation of panel of villages for analysis and	Within 3 months from commencement of work

		preparation of inputs for running water budgets for last four years	
III		**Water** - Note on village-level extension activities in kharif 2023 in the selected villages in two pilot districts - Report on training of extension agents during kharif 2023 including water budget runs at DSAO offices - Report on baseline data collection and guidelines for using collected data in rabi hangam baithaks - Report on field testing and refinements to rabi planning module - Note on support to PMU for changes to MLP and village water balance charts *IT / Extension:* - Input datasets for rabi planning module in the form of csv / tables, along with technical documentation and SoP - Training material such as presentations, survey formats, planning protocols etc. **Energy** - Detailed report on status of 10 DTs selected for capacitor scale-up - First version of design specifications and functionality of load management app - Output of energy estimation tool from 10 villages - Support to PMU for integration of energy estimation tool into MLP app, and interface for feedback in rabi baithak; - Final set of training material developed for ICC **(I) Special advisory component** - Interim report on Image-Classification-based and AIML-based advisories *IT* - First version of code/scripts for the advisories **(J) Analysis of water budget indices and trends** - Final closure report on computation of indices, analysis of trends and findings	Within 6 months from commencement of work

IV	Water
	  - Note on conduct of rabi hangam baithaks and use of rabi planning module in the selected villages
	  - Note on guidelines to scale-up data collection and conduct of rabi hangam baithaks to all villages
	  - Note on changes to rabi planning module and design of interface for integration of rabi planning module into MLP with technical documentation and workflow
	
	IT / Extension:
	  - Rabi hangam baithak and data collection guidelines
	  - Rabi planning module scripts / code in the format of integration into PoCRA system
	
	Energy
	  - Report on energy ICC discussion in rabi hangam baithak in 10 villages
	  - Summary on results of rabi baithak from 2 districts
	  - Material shared in village meetings for capacitors demonstration
	  - Feedback from DT on the app usage and load management experience
	
	Special advisory component (I)
	  - Closure report on Image-Classification-based and AIML-based advisories, with technical documentation and SRS
	IT
	  - Final version of code/scripts for the advisories in the format of integration into PoCRA system
		Within 9 months from commencement of work

V	Water
	  - Report on changes to Regional Geography - surface water flow model based on feedback from the field observations during Kharif 2023.
	  - Report on conduct of zone-level meetings, annual water budgets and comparison of proposed and actual cropping patterns in the selected villages
	  - Closure note on Extension activities - learnings and feedback
	  - Handover report for district water budget
		Within 12 months from commencement of work

	computation and extension framework and policy brief for mainstreaming extension activities beyond PoCRA region - Policy brief based on all MoUs (I to V) *IT / Extension:* - scripts / code for RG surface-water flow model, with technical documentation, SRS - Training material such as Village Resource book, presentations on Extension Activities during Rabi <u>Energy</u> - Report on results of capacitor demonstration and village response <u>IT</u>. - Load management app with scheduling in the format of integration with PoCRA system	

Table 5.1 Detailed Activities

II Energy and Project Support

Components	Activity / Deliverable	Person months (p-m)	Research (p-m)	Technical (p-m)	Field* (p-m)	Extension** (p-m)	IT Design (p-m)	Output
A. Kharif advisory and reporting framework								
1	Analyze the historical FFS data in order to establish triggering conditions for a few, selected contingencies	2		1			1	Note
2	Identification, selection and prioritization of weather, soil-moisture and water-budget based advisories and automated reports to be generated during kharif 2023	0.5		0.5				Report + IT
3	Design reporting framework, formulate advisory triggers, formats, write code, test results for advisories and reports selected by PMU	2		1			1	
4	Assist PMU to Identify, design and develop the dissemination mechanism (a report or an SMS or whatsapp etc.) for each advisory	1		0.5			0.5	
B. District climate-resilience planning framework								
1	Visit the District Agriculture office and understand the requirements of DSAO with regards to	0.5					0.5	

Compone nts	Activity / Deliverable	Person months (p-m)	Resear ch (p-m)	Techni cal (p-m)	Field* (p-m)	Exten sion** (p-m)	IT Design (p-m)	Output
	contingency planning for climate resilience, current planning activities and tools, limitations in using PoCRA water budgets etc.							
2	Hold a workshop for the District Superintendent Agriculture Officers of all the 15 PoCRA districts to demonstrate the use-cases of the water budget and advisories for planning and contingency at the district level	1				0.5	0.5	
3	Design and set up an interface at the DSAO for receiving timely advisories, updates, water budget reports etc. from the PMU / DoA as well as to visualize the primary data collected by the AAs from the villages.	1					1	
4	IT support to DSAO for the water budget computation during kharif.	2					2	Report + IT
5	Planning support to DSAO for designing the extension strategy and dissemination of water budget results and advisories to village level during kharif and post-kharif.	3		1	1	1		
6	Closure of district activities, handover and feasibility report for scaleup of district water budget computational framework to the whole state.	2	2					Report
	C. District climate-resilience extension framework							
1	Hold introductory meetings in selected villages to brief the outline of extension activities to be carried out during kharif and rabi seasons	1				1		
2	Design training material and survey formats and other material to be used during extension activities	3		1			2	Report
3	Hold training workshops for AAs and CAs for conduct of surveys, collection of primary data, implementation of water budget calendar, conduct of hangam baithaks etc.	1.5		0.5		0.5	0.5	
4	Work with school children and teachers for installing rain gauges in the selected villages and for recording, documenting, displaying daily rainfall data	6			6			

Compone nts	Activity / Deliverable	Person months (p-m)	Resear ch (p-m)	Techni cal (p-m)	Field* (p-m)	Exten sion** (p-m)	IT Design (p-m)	Output
5	Collect baseline data in the selected villages through NRM surveys and farmer interviews along with the AAs and CAs	9			9			Report
6	Conduct rabi hangam baithaks in the selected villages	7		0.5	6		0.5	Report
7	Prepare a village resource book and devise a mechanism to update it every year /season and make it available and accessible to all in the selected villages.	3		2			1	Report
8	Run the annual water budget for the selected villages, prepare new improved charts and display them in the villages and conduct closure meetings in the selected villages	4		0.5	3		0.5	
D. Rabi planning framework								
1	Conduct focused group discussions in selected villages for documenting key inputs required by the rabi planning module	5		1	4			Report
2	Conduct on-field tests of the LP (Linear Programming) model for testing various input scenarios	5		1	4			
3	Refine and improve the LP model based on feedback from the field	2		1			1	
4	Design interface for the rabi planning module and assist PMU to integrate rabi planning module in the MLP for effective community decision-making during rabi hangam baithaks	3		1.5			1.5	Report + IT
5	Demonstrate the use of rabi planning module in the selected villages	4				4		Report
6	Conduct zone-level meetings in the selected villages to verify the results of the rabi planning module and demonstrate use of water budget results	8		1	6		1	
E. Improvements and refinements to water budget model								
1	Incorporate NBSS and other available improved input datasets in the water budget model, test results and get approved by PMU	1		0.5			0.5	Report + IT

Components	Activity / Deliverable	Person months (p-m)	Research (p-m)	Technical (p-m)	Field* (p-m)	Extension** (p-m)	IT Design (p-m)	Output
2	Improvements in code-efficiency, setup of automated scripts and dry run of the real-time water budgets for kharif 2023	1					1	
3	Prepare zones and prepare water budget scripts for all the non-PoCRA villages in the selected districts.	1.5		0.5			1	
4	Run Regional Geography (RG) for the selected 10 clusters during kharif 2023	1					1	
5	Refine Regional Geography (RG) Surface flow module through feedback from the field observations exercise done during kharif 2023	3		1			2	Report
6	Assist PMU in changes to MLP and village water budget charts as proposed during MoU IV	2		2				Note
J. Analysis of water budget indices and trends								
1.	Collection and curation of input datasets (cropping pattern, NRM structures, DBT data, M & E data etc.) for last four years, and preparation of panel of villages	2		1			1	
2	Preparation of inputs, running of water budgets with above input datasets for last four years	2					2	
3	Computation of water budget indices and analysis of trends over last four years	3					3	
4	Final report writing	1		1				
	Water Total	94		22	39	07	26	

Energy component

F.   Structured demonstration of capacitors in 10 villages

1	Selection of 10 DTs from 10 villages of 2 talukas/ 2 districts	3			3			Report
2	Collection of data about each DT through farmers surveys, field surveys, network analysis, and preparation of report on status of DT	7	2	2	3			Report

Components	Activity / Deliverable	Person months (p-m)	Research (p-m)	Technical (p-m)	Field* (p-m)	Extension** (p-m)	IT Design (p-m)	Output
3	Prepare communication and awareness building material and protocol	4	2	2				Extension material
4	Village meetings to share results and show awareness building material. Getting capacitors installed.	5		0.5	3	1.5		Report
5	Conduct power factor measurements at DT during rabi. Survey farmers. Get feedback about any issues	3		1	2			Report
6	At the end of rabi, conduct surveys. Estimate number of pump breakdowns, tripping etc. Prepare material for presentation to village. Conduct village meetings to present results.	3.5	1		1	1.5		Extension material / Report
G. Load Management app upgrade to include scheduling								
1	Select 6 DTs to get inputs for development of app	2		1	1			Report
2	Design and develop the schedule automation	8	2		2		4	IT
3	Develop app	7	1		2		4	IT
4	Test and feedback in rabi from those DTs	3.5				2	1.5	Report
H. Implementation of Energy estimation tool in 10 villages towards ICC								
1	Identify 10 villages from 2 talukas/ 2 districts	1.5		1	0.5			Report
2	Develop training material for the krishi sahayaks to understand the Information, Comprehension, and Collective action with regard to energy infrastructure in the village	5	2	3				Training Material
3	Conduct training in 10 villages	4				4		Document
4	Validate internal integrity of data from krishi sahayaks in 10 villages and output of the MLP tool	3	2				1	Report
5,6,7	Incorporate improvements in Energy estimation tool model and in interface for data collection. Support to PMU to integrate input interface into MLP app.	2					2	IT
8	Observe and get feedback at the rabi hangam baithak in 10 villages	2		1	1			Report

Components	Activity / Deliverable	Person months (p-m)	Research (p-m)	Technical (p-m)	Field* (p-m)	Extension** (p-m)	IT Design (p-m)	Output
9	Develop checks for quality of data collected in rabi hangam baithak	3.5			1.5	1.5	0.5	Report
	Energy Total	67	12	11.5	20	10.5	13	
I. Special component for image-classification-based and AIML-based advisories								
1.	Image-classification-based advisories: analyze and collate existing / procured crop digital libraries, develop image classification and annotation algorithms, integrate with existing advisories	6	2				4	
2.	AIML-based advisories: study current rule-based advisories, prepare training dataset based on farmer positive and negative responses for current advisories, develop machine learning tools to improve feedback, integrate with existing advisories	6	2				4	
	Component I Total	12	4				8	

6.0   Terms and Conditions:

6.1   Services:

(i) The Second Party shall perform the services specified in point 5.0 Reporting Obligations for the second Party.

(ii) The Second Party shall submit to the First Party, the reports listed in *5.0* Reporting Obligations of the Second Party and Review Mechanism within the time periods listed therein.

(iii) The Second Party shall provide the personnel listed in Annexure I, to perform the Services.

6.2   Term:

The Second Party shall perform the Services as agreed by the parties in writing and continuing through twelve months or any other period as may be subsequently agreed by the parties in writing.

6.3 Payment:

A. <u>Ceiling</u>

For Services rendered pursuant to Annexure - I, the First Party shall pay the Second Party an amount not to exceed Rs. 2,18,58,000/- (Excluding applicable taxes). This amount has been established based on the understanding that it includes all of the Second Party's costs and overheads.

B. <u>Schedule of Payments:</u>

The schedule of payments is specified below:

Phase	Duration	Payment#
Phase I	Within 15 days from commencement of work	10% of Agreement cost
Phase II	3 months from commencement of work	25% of Agreement cost
Phase III	6 Months from commencement of work	20 % of Agreement Cost
Phase IV	9 months from commencement of work	25 % of Agreement cost
Phase V	12 Months from commencement of work	20 % of Agreement cost

 # Payment shall be made after acceptance by PMU, PoCRA of the deliverables mentioned in Phase I - VI.

C. Payment Conditions

Payment shall be made in Indian Rupees within 30 days following submission by the Second Party of invoices in duplicate to the coordinator designated in Para 6.4.

Payments shall be made to Second Party's bank account

Name of Account Holder: Registrar IIT Bombay, Project and Consultancy Account

Contact Details: Adishankaracharya Marg, Powai, Mumbai, 400076

Contact no. 91-22-25767020/ 7032/ 9769257032

Fax no.: 91-22-25764034

Email Address: registrar@iitb.ac.in / sivakami@iitb.ac.in

Bank Name: State Bank of India

Bank Branch: IIT Powai

Branch Address: Adishankaracharya Marg, Powai, Mumbai 400076

Contact no.: 91-22-25722894/ 1103 / 2900/ 5305

Email id: sbi.01109@sbi.co.in

Account no.: 10725729173

ECS/MICR Code: 400002034

Account Type: Current

SWIFT/BIC/IBAN: SBININBB519

NEFT / RTGS / IFSC: SBIN0001109

Branch Code: 1109

BSR Code: 0001109

6.4   Administration:

A. <u>Coordinator</u>

The First Party designates the Agriculture Engineer of the PMU as First Party's Coordinator; the Coordinator shall be responsible for the coordination of activities under the MoU, for receiving invoices for payment, and for acceptance of the deliverables by the First Party.

The Second Party designates the Project Coordinators as the Project Investigator and the Co-Project Investigator from IIT Bombay as Second Party's Coordinators: the Coordinators shall be responsible for the submission of deliverables by the Second Party.

B. <u>Reports</u>

The reports listed in 'Table 5.0 Reporting Obligations of the Second Party and Review Mechanism' shall be submitted in the course of the assignment and will constitute the basis for the payments to be made under paragraph 6.3.

6.5   Performance Standards:

The Second Party undertakes to perform the Services with the highest standards of professional and ethical competence and integrity. The Second Party shall promptly replace any personnel assigned under this MoU as may be mutually agreed between the Parties.

6.6   Inspections and Auditing:

The Second Party shall permit, and shall cause its Sub-Consultants to permit, the First Party and/or persons or auditors appointed by the First Party to inspect and/or audit its accounts and records and other documents relating to the submission of the Proposal to provide the Services and execution of the MoU.

6.7   Confidentiality:

The Second Party shall not, during the term of this MoU and within two years after its expiration, disclose any proprietary or confidential information relating to the Services, this MoU or the First Party's business or operations without the prior written consent of the First Party.

6.8   Ownership of Material:

Any studies, reports or other material, graphic, software or otherwise, prepared by the Second Party for the First Party under the MoU shall belong to and remain the property of the First Party. The Second Party may retain a copy of such documents and software[1]. The Second party can use it for research and academic purposes with the prior approval from the first party. Any equipment procured by the second party for the purpose of this assignment will be handed over to the first party at the end of the assignment.

6.9   Left Blank:

6.10   Insurance:

The Second Party will be responsible for taking out any appropriate insurance as required.

6.11   Assignment:

The Second Party shall not assign this MoU or Subcontract any portion of it without the First Party's prior written consent.

6.12   Law Governing this MoU and Language:

The MoU shall be governed by the laws of India, and the language of all MoU related documents shall be English.

6.13   Dispute Resolution[2]:

Any dispute arising out of this MoU, will be amicably settled between the parties.

6.14   Termination:

6.14.1. Either party hereto may terminate this MoU by provision of a thirty (30) days' notice to the other party citing reasons.

6.14.2. The First Party may terminate this MoU with at least ten (10) working days prior written notice to the Second Party after the occurrence of any of the events specified in paragraphs (a) through (d) of this Clause:

(a) If the Second Party does not remedy a failure in the performance of its obligations under the MoU within seven (7) working days after being notified, or within any further period as the First Party may have subsequently approved in writing;

(b) If the Second Party finds it necessary to cancel the assignment and/ or shorten or extend its duration or becomes insolvent or bankrupt;

(c) If the Second Party, in the judgment of the First Party or the Bank, has engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices (as defined in the prevailing Bank's sanctions procedures) in securing or in executing the MoU.

(d) If the First Party, in its sole discretion and for any reason whatsoever, decides to terminate this MoU.

6.14.3. In the event of termination, the Second Party shall refund to the First Party, all payments made for providing remaining part of activities and the Second Party shall provide the First Party any reports or parts thereof, any other information and document gathered under this MoU prior to the date of termination.

7.0   Annexures:

Annexure – I: Second Party's Personnel and corresponding Unit Rates and Budget

Annexure - II: Key Staff and Professionals

In affirmation and witness whereof, the parties hereto have caused this agreement and a copy thereof on their respective behalf by their duly authorized officials on the date and place herein mentioned.

FOR THE 'FIRST PARTY'   **FOR THE 'SECOND PARTY'**

Signed by …………………   **Signed by ……………………**

Title.………………………...   **Title.……………………………**

Date ………………………   **Date …………………………...**

Place ……………………….   **Place ………………………….**

Seal: **Seal:**

In the presence of the following witnesses:

1.

2.

In the presence of the following witnesses:

1.

2.

---

[1]Restrictions about the future use of these documents and software, if any, shall be specified at the end of Para 6.8

[2] The provision may be modified appropriately if both the First Party and the Second Party are Government Entities.

Annexure I

Second Party's Personnel and corresponding Unit Rates

Sr. No	Name of Personnel	Unit Rate (Rs. per month)	Number of Man - Months	Total (lakh)
A. Water budget and Project Support				
1	Prof. Milind Sohoni	30000 per person day	20 person days	6
2	Project Manager	150000	12	18
3	Senior IT consultant	150000	10	15
4	Team Leader	80000	10	8
5	IT assistant	60000	12	7.2
6	Field coordinator 1	50000	10	5
7	Field coordinator 2	50000	10	5
8	Field staff 1	30000	10	3
9	Field staff 2	30000	10	3
10	Local field staff 1	20000	3	0.6
11	Local field staff 2	20000	3	0.6
12	Student honorariums	50000	4	2
Total Human Resource				73.4
Head-wise totals				
Human Resources				73.4
Logistics (Travel + Food + Accommodation)				13.5
Consumables (Rain-gauges + training material / stationery required for meetings, workshops)				3
DSAO and Agriculture Assistant workshops				3.7
Contingency				6
Total (A)				**99.6**
B. Energy		Unit Rate (per month)	Number of Months	Total (lakh)

1	Prof. Priya Jadhav	30000 per faculty day	35	10.5
2	Project Research Engineer (1)	75000	12	9
3	Project Research Assistant (2)	60000	24	14.4
4	Field staff (2)	30000	18	5.4
5	IT Assistant	60000	10	6
6	Senior IT consultant	150000	3	4.5
Total Human resource				**49.8**
Head-wise totals				
Human Resources				49.8
Travel + Logistics:				14
Capacitors				3
Contingency				4
Total (B), lakhs				**70.8**

C. Special Advisory R&D		**Unit Rate (per month)**	**Number of Months**	**Total (lakh)**
1	Faculty	30000 per person day	10 person days	3
2	AIML expert	100000	6	6
3	Image processing expert	100000	6	6
Total (C), lakhs				**15**

Total (A + B + C), lakhs	**185.4**
Total (A + B + C), lakhs + [IITB overheads (on non-faculty costs) = 33.18L]	**218.58**

* Exclusive of all taxes and 0% overheads for faculty fee

* Phase wise payment will be made as per 'B. Schedule of Payments' in point 6.3

Note:

1. **The manpower and salaries are indicative and allocation may be changed within the salary head for effective implementation.**

Annexure II

Key Staff / Professionals required

SI No.	Positions	Qualification and Experience	Number
1	Project Coordinator: Water (CV indicating the qualifications and experience to be enclosed)	Professor or equivalent position with experience in management of multi-disciplinary projects related to Natural Resource management, watershed Management, hydrological modelling, etc.	1
2	Project Coordinator: Energy (CV indicating the qualifications and experience to be enclosed)	Faculty with experience in management of multi-disciplinary projects related to Agricultural water and energy consumption	1
3	Project Manager (CV indicating the qualifications and experience to be enclosed)	Doctorate degree in the field relevant to natural resource management with experience in management of multi-disciplinary projects related to Natural Resource management, watershed Management, hydrological modelling and IT projects etc with government agencies	1
4	Senior IT Consultant: Water + Energy (CV indicating the qualifications and experience to be enclosed)	Masters degree in Computer Science / IT Engineering and more than 10 years of experience in development and use of IT tools for multi-disciplinary projects,	1

6	Team Leader -: Water (CV indicating the qualifications and experience to be enclosed)	Masters degree in the field relevant to natural resource management / rural development and at least 3 years of work experience with government agencies in management of multi-disciplinary projects in the development sector such as agriculture, watershed management etc.	1
7	Field Coordinator: Water (CV indicating the qualifications and experience to be enclosed)	Bachelor's or higher degree (preferred in Civil Engineering) with at least one year of field experience with required skills in field surveys, documentation, data analysis and basic knowledge of agriculture and hydrology.	2
8	Field Staff: Water (CV indicating the qualifications and experience to be enclosed)	Bachelor's or Diploma degree in Engineering or BSc./MSc. degree in Agriculture, Environmental Science, Geography with basic skills in field surveys, documentation and data analysis.	2
9	Field Staff: Energy (CV indicating the qualifications and experience to be enclosed)	Bachelor's or Diploma degree in Engineering or BSc.in Electronics, or Physics, with required skills in field surveys, documentation, data analysis and basic knowledge of electrical systems.	2
9	Project Research Engineer: Energy (CV indicating the qualifications and experience to be enclosed)	Masters degree in the field relevant to natural resource management / rural development with one to two years experience in management of multi-disciplinary projects in the development sector such as agriculture, rural electrification, pumping systems, data analysis	1

10	Project Research Assistant: Energy (CV indicating their qualifications and experience to be enclosed)	Bachelor's or higher degree with at least two years of experience in management of multi-disciplinary projects related to Natural Resource management/ agriculture / electrical engineering, stakeholder management, data analysis	2
11	IT Assistant: Energy (CV indicating the qualifications and experience to be enclosed)	Bachelors or higher degree with experience in development with at least one year's experience (Android apps, Python, postgres / other database systems, knowledge of GIS)	1
12	IT Assistant: Water (CV indicating the qualifications and experience to be enclosed)	Bachelors or higher degree with at least one year's experience in development and management of IT Systems (Python, postgres / other database systems, knowledge of GIS)	1