**Terms of Reference (ToR)**

**for**

**Selection of a consulting firm to setup Internet of Things (IoT)- based milk analyser in livestock firms and develop a web application dashboard to show the cow wise milk quality parameters from the milk analyser**

# Background

The Rural Microenterprise Transformation Project (RMTP) is being implemented by PKSF with the joint financing of the International Fund for Agricultural Development (IFAD), and DANIDA. The project is working to extend the financial services of microenterprises and improve the income, food security, and nutrition status of small and marginal farmers, entrepreneurs, and other market actors involved in the value chains of selected high-value agricultural products. The project is implementing value chain development activities to expand the markets for comparative advantage, market demand, and growth of agro-based products. There are provisions for product processing, certification, and marketing by brand image creation in the country and abroad through this project. Also, there are provisions to introduce various new technologies, and methods such as Artificial Intelligence (AI), Internet of Things (IoT), Blockchain, Crowd Funding Platforms under this project for poverty alleviation.

The livestock sector in Bangladesh has shown its strong presence with a fast-growing market for meat and dairy products. To provide its 165 million populations with sufficient, safe and nutritious food, the government has deployed great efforts in reforming the whole livestock sector, of which dairy and beef sub-sectors have been given particular emphasis. As an agriculture-based country, the majority of the rural households adopt a mixed farming system by cultivating crops and rearing livestock at the same time. Among the animals raised, cattle are considered as the most valuable asset for small-scale farmers in terms of its meat and milk producing functions. However, the bottlenecks existing in cattle rearing as well as along the entire downstream value chain largely constrain rural households to climb out of poverty. According to DLS, the livestock subsector provides 20% of the population with direct jobs and 45% with part-time jobs. This is particularly important for unemployed youth and women, as well as landless farmers, to lift themselves out of poverty.

“Market development of safe meat and dairy products” a value chain development sub-project has been implementing under RMTP in different regions of Bangladesh by several partner organizations (POs). Among them ‘Gram Unnayan Karma (GUK)’ a PO of PKSF from Bogura is implementing this sub-project in Bogura (Bogura Sadar, Shajahanpur, Sherpur, Gabtali, Sariakandi, Shibgonj Upazila). This sub-project launched for strengthening existing business cluster through Good Livestock Practices, improve technologies and market linkages as well as to enhance the income of livestock farmer community.

“GUK” has taken initiative to monitor the cow wise milk parameters of any farms through setting-up IoT-based milking analyzer machines and syncing it’s data in a web-based dashboard. It’ll ensure any abnormalities in milking parameters (water, fat, proteins, carbohydrates, minerals, vitamins and SNF). A consulting firm will setup the available IoT-based milk analyzer devices that are able to show data in web-based dashboard and develop the web-based platform as well. This dashboard will act as the preliminary step to monitor and maintain the quality of milking parameters of cows in a farm and flourish the linkages among the actors of the livestock supply chain.

**2. Objectives of the assignment:**

a. The IoT-based milk analyser device will be installed for detecting the milk parameters-

1. Water;
2. Fat;
3. Proteins (including casein and whey proteins);
4. Carbohydrates (mainly lactose);
5. Minerals (including calcium, phosphorus, and magnesium);
6. Vitamins – Milk contains vitamins such as A, D, B12, and B2;
7. SNF (Solid Not Fat) is an important parameter used to assess milk quality, which includes the proteins, lactose, and minerals.

b. web application will be developed with a view to creating-

1. a dashboard that will show the synced data from the milk analyser.
2. cow wise milk quality monitoring features.
3. quality control mechanisms if any abnormalities are flagged.

**3. Scope of the assignment:**

The consulting firm will develop this smart application focussing the farms in Bogura initially. The details of technical works to be done by the consulting firm are as follows.

1. Initially 10 (probable) IoT-based milk analyzer devices will be installed by the consulting firm in selected farms as a piloting. Subsequently, the number of devices may be increased or decreased based on the requirement and budget.
2. Entrepreneur/Farmer will have access to the web application to be developed by the consulting firm so that, he/she may input farm information (ID, Farmers Name, Area, Date of establishment, Manpower involved, contact number, Location, Number of Cows, cows breed, age, number of parturitions, vaccination, deworming schedule, AI (artificial insemination) dates, history of illness, advice, and the formulation of the feed being given to each animal, etc.
3. Farmer may set-up his/her profile too including Id, name, gender, contact number, NID, number of farms, location, photo etc.
4. After creating farm profile, farmer may be able to input cow wise milk parameter information. Every farm will consist of a number of cows and each cow will be identified with a unique ID.
5. Cow ID wise milk parameters will be shown inside each profile of a cow and the data will be synced from the IoT-based milk analyzer device.
6. Each parameter will be controlled based on its standard value. If any abnormality happens for any parameter, then the system will notify the farmer identifying the cow id in his/her farm. The system will also be able to advise on what types of steps need to be taken for any abnormality.
7. Parameters that will be measured through milk analyzer device are provided above in scopes of this assignment (Water, Fat, Proteins, Carbohydrates, Minerals, Vitamins and SNF).
8. Language of the application will be in Multilingual (Bangla and English).
9. A user manual should be developed in Bangla and English.

**4. Deliverables:**

a) Consulting firm will have to submit an inception report, detailed work plan and time schedule in line with time limit mentioned in this ToR, a detailed requirement specification for this assignment, should be agreed by ‘GUK.

b) Consulting firm will have to install the milk analyzer devices properly. They should provide specific training to the relevant stakeholders including the installation of device, it’s operation and web dashboard management as well.

c) Consulting firm should provide draft report including demo application and its findings to ‘GUK’ within stipulated timeframe. Draft report should be included with specific learning, challenges and recommendations that will suggest what to do in future. Concerned person from the consulting firm will have to give a presentation at ‘GUK’ on the draft report highlighting major findings and recommendations regarding the requirements.

d) Final report of the assignment has to submit within 07 days from the date of presentation given on the draft report. The report should be written in English and in such a way that it is understandable to a non-specialist. The final report should have the reflections of the comments made in draft report presentation. Consulting firm have to provide a brief of the findings corresponding to the object of the assignment in plain language that can be widely circulated. The brief of the assignment could be within 5-10 pages. A user manual in bangla and english also need to submit with the final report.

e) The hard copy of the final report including soft copy with source code in a CD/DVD/USB drive must be submitted to ‘GUK. ‘GUK will be the sole proprietor of the devices and the web application. The source code under this application should not be shared with or used by any other person or organization without the written consent of ‘GUK.

**5. Timeline:**

The time limit for submitting the inception report will be 15 days from the contract sign. After contract signing. The installation of milk analyzer device including demo application with draft report submission time limit will be 2 months from the contract signing. The final report with user manual of the assignment should be submitted within 15 days after the presentation given by the consulting firm on the draft report (2 months and 15 days from the contract signing). So, the assignment completion timeframe will be 2 months and 15 days.

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| **Stages** | **Activities & Deliverables** |
| Initial Stage | Inception Report |
| Installation of IoT-based milk analyzer devices and Demo application with draft report | Submission of Mock Designs, SRS, URS documents based on the demo application |
| Deployment Stage | Final application with user manual and report. |
| Delivery Stage | Software deployed in production environment and operating smoothly |

**6. Technology platform (Please provide some detailed description)**

**a. Back End**

i) Java/.Net/Python/PHP frameworks with HTML, DHTML, JavaScript, etc.

ii) For responsive web applications,

 Bootstrap and CSS3.

**b. Front End**

i)React/Angular/Vue JS frameworks with HTML5, CSS3 and JavaScript alike common languages.

**c.** **Proposed Database**

MySQL, PostgreSQL, MongoDB etc.

**d. API Layer**

 **RESTful APIs** as-

1. HTTP methods: GET, POST, PUT, DELETE
2. JSON or XML-based communication with swagger/postman etc. API testing tool.

**Technical Support:**

1. Technical Support for the database (update, backup, restoration) up to June 2026 after the final installation and delivery.

c) Technical support for the devices and web application (maintenance support, content management, structure modification) will be up to the project period from the date of final installation and delivery [Later support should also be continued upon demand and payment by the farmers].

**7. Qualification and Experience of the Consulting Firm:**

1. The consulting firm should have at least 5 years of experience in software project design and development.
2. Income tax assessment certificate/acknowledgement certificate; Trade license; VAT certificate; and Registration certificate if applicable;
3. List of organizational committee members/board of directors;
4. Provide bank solvency certificate along with the last 3 months' financial transaction statement from the EOI submission date;
5. Required logistics (such as computers, printers, photocopiers, etc.);
6. List of existing senior management and assignment-related professional manpower;
7. List of completed assignments during the **last 3 years** including two (2)successfully developing software project regarding mobile applications**.**
8. A brief description regarding the most expertise areas especially related to this assignment;
9. List of ongoing assignments**;** and
10. In the case of a Joint Venture, must have a legal agreement among the firms where the name of the leading firm needs to be mentioned. The Lead firm needs to fulfil all the above conditions.
11. **Team Composition:** The team will consist of 6 professional experts. Qualifications and competence of each expert for the assignment are given below:
12. **Project Manager (1 person):**
13. **Educational qualifications:** Minimum 4 Years Bachelor’s degree in Software Engineering **(SE)**/ Computer Science (CS)/ Computer Science and Engineering (CSE)/ IT/ Mathematics/ Physics.
14. **Experiences**: 5+ years of experience in software/hardware integration projects and List of assignments completed in the last 03 years. Freelance experiences will be considered too.
15. **Key Skills:** Project planning ang management, Communication and documentation.
16. **Other Skills:** Software testing and debugging**,** Computer networking, Graphics, etc.
17. **Front-end Developer (1 person):**
18. **Educational qualifications:** Minimum 4 Years Bachelor’s degree in Software Engineering **(SE)**/ Computer Science (CS)/ Computer Science and Engineering (CSE)/ IT/ Mathematics/ Physics.
19. **Experiences**: List of web application-based assignments completed in the last 03 years. Freelance experiences will be considered too.

Software/application development experience in react, php frameworks like codeigniter or laravel, firebase, application programming interface (api) using relevant frameworks in php or others.

1. **Other Skills:** Software testing and debugging**,** Graphics (UI/UX) etc.
2. **Back-end Developer (1 person):**
3. **Educational qualifications:** Minimum 4 Years Bachelor’s degree in Software Engineering **(SE)**/ Computer Science (CS)/ Computer Science and Engineering (CSE)/ IT/ Mathematics/ Physics.
4. **Experiences**: List of web application-based assignments completed in the last 03 years. Freelance experiences will be considered too.

Software/application development experience in react, php frameworks like codeigniter or laravel, python, java, application programming interface (api) using relevant frameworks in php or others.

1. **Other Skills:** Software testing and debugging**,** Computer networking etc.

1. **IoT Engineer (1 person):**
2. **Educational qualifications:** Minimum 4 Years Bachelor’s degree in Electrical/Electronics Engineering/ Software Engineering (SE)/ Computer Science (CS)/ Computer Science and Engineering (CSE)/ IT/ IoT/Mechatronics.
3. **Experiences**: List of IoT-based assignments completed in the last 03 years. Freelance experiences will be considered too.

Embedded system development experience in C/C++, micro python using different platforms like ESP32, Raspberry Pi, Arduino etc.

1. **Key Skills:** Using communication protocols, sensor interfacing, device calibration, power management etc.
2. **Other Skills:** Software testing and debugging**,** Computer networking etc.
3. **Firmware Engineer (1 person):**
4. **Educational qualifications:** Minimum 4 Years Bachelor’s degree in Electrical/Electronics Engineering/ Software Engineering (SE)/ Computer Science (CS)/ Computer Science and Engineering (CSE)/ IT/ IoT/Embedded Systems.
5. **Experiences**: List of firmware development assignments completed in the last 03 years. Freelance experiences will be considered too.

Embedded system development experience in C, Bare-metal programming, RTOS-based system, Serial protocols (UART, I2C, SPI etc.), Debugging tools (JTAG, oscilloscopes etc.).

1. **Other Skills:** Software testing and debugging**,** Computer networking etc.
2. **QA/Test Engineer (1 person):**
3. **Educational qualifications:** Minimum 4 Years Bachelor’s degree in Software Engineering (SE)/ Computer Science (CS)/ Computer Science and Engineering (CSE)/ IT/ Software Quality Assurance.
4. **Experiences**: List of manual and automated test assignments completed in the last 03 years. Freelance experiences will be considered too.
5. **Key Skills:** Test case design, Bug reporting, Knowledge of integration, regression, UAT, deployment etc. testing.

Using testing tools like Selenium, postman, Jmeter, Cypress etc.

1. **Other Skills:** Software debugging.
2. **Consulting Firm (National) Selection Process:**

Quality and Cost Based Selection (QCBS) method on lump-sum contracts of Schedule 1 of the Public Procurement Rules-2008 of the Government of Bangladesh shall be followed in the preparation of short-listing the firms, evaluation of documents containing a request for submission of proposals, selection the firm, negotiation, signing of contract and receipt of survey reports for conducting this study.

1. **Service and facilities to be provided by the client**

The necessary information on the assignment will be provided by PKSF RMTP’s PMU and GUK. Additionally, PKSF/GUK will also provide necessary guidance and comments on the Mock Designs, SRS, URS documents based on the demo application within the stipulated time. The client will not provide any logistic support to the firm. If necessary, officials of PKSF/Guk may accompany the crews while visiting the fields.

1. **Service and facilities to be provided by the firm**

The firm will provide the deliverables within the mentioned period using their own office space and other necessary logistics. Additionally, the firm will host any member of the client while making correction to the draft versions of Mock Designs, SRS, URS documents based on the demo application. The firm will deploy all the final application with user manual and report and ensure smooth operation of the software.

1. **Institutional arrangement:**

The consulting firm will report to the `Project Focal’ and/or his/her designated person regarding their scope of services, deliverables and other assignment related issues.

1. **Mode of Payment**

‘GUK’ will pay the cost of the assignment to consultant subject to the completion of all outputs and acceptance. Payments will be made based on the following percentages and milestones:

1. 1st Payment (25% of total contract value): The 1st payment will be made upon submission and acceptance of the inception report with detailed workplan by ‘GUK’.
2. 2nd Payment (50% of total contract value): The 2nd payment will be made upon installation of milk analyzer devices including submission and acceptance of the draft report including demo application by ‘GUK’.
3. Final Payment (25% of total contract value): The final payment will be made upon services and maintenance of the devices during the project period and acceptance of the final report by ‘GUK’.