

Assessing the PhilRice Rice Engineering and Mechanization Division Workshop

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Abstract- *The PhilRice Rice Engineering and Mechanization Division (REMD) serves as a core research unit within PhilRice, focusing on engineering aspects of rice Research for Development (R4D). This study assessed the performance of the REMD workshop, which supports R4D activities by housing equipment for prototype fabrication and machine testing. The research studied the effectiveness of the workshop in achieving its objectives and identifies strengths and weaknesses related to facility resources, workers, and processes. Employing a mixed-methods approach, this study combined qualitative and quantitative methods to gain a comprehensive understanding of the workshop's dynamics. In-depth interviews, observations of daily operations, and feedback forms were employed to collect data from workshop supervisors, technicians/workers, and clients. The study analyzed the quality of services provided, organizational structure, management of supplies and materials, equipment maintenance, and client feedback. The results showed that the REMD workshop has positively impacted its clients through timely and quality service delivery. Feedback indicates high client satisfaction in terms of timeliness, quality of produce, and general appearance. However, the study also highlighted areas requiring attention. These include the need for centralization of supplies and materials, upgrades to outdated equipment, and a clearer system for the supervision and management of shop technicians.*

Indexed Terms- *Philrice, Workshop, Prototype Fabrication.*

I. INTRODUCTION

The PhilRice Rice Engineering and Mechanization Division (REMD) is a research division of PhilRice focusing on the engineering aspect of rice Research for Development (R4D) as its core function. It develops engineering technologies that are suited for local introduction and caters to the needs of the Filipino farmers.

The Field Service Building or Workshop facility of Rice Engineering and Mechanization Division (REMD) was built as support facility to strengthen the conduct of R4D activities of the Division. The facility houses the equipment for research-related activities such as prototype fabrication and machine testing. It serves as the extension arm of REMD where prototype designs are turn into tangible prototypes. Keeping the facility and equipment in good working condition is of utmost importance to ensure smooth operation and delivery of expected outputs of the Division.

Over the years, REMD workshop has developed prototypes of rice engineering technologies. In recent years, the shop's operation was expanded to cater requests of external clients for particular engineering technologies that helps bring research outputs directly to the client.

A workshop is typically defined as a designated space, such as a room or a building, equipped with the tools, machinery, and workbenches required for manufacturing or repairing products. Additionally, workshops may be utilized for small-scale manufacturing or handcraft operations. Workshops serve to facilitate experimentation and prototyping,

aside from their primary function of repairing goods or undertaking small manufacturing tasks (Asoegwu, 2022).

Access to modern and efficient agricultural machinery, along with the adoption of new technologies, is essential for the economic development of agriculture. Workshops that can assist in the modernization and maintenance of agricultural machinery play a central role in this endeavor (Osuch et al., 2020). Additionally, Osuch et al. (2020) describe various evaluations of a workshop's effectiveness for agricultural machinery. Key factors in these evaluations include reliability, capability, financial constraints, maintenance protocols, preventive strategies, decision-making frameworks, and risk mitigation plans.

II. LITERATURE REVIEW

Mechanization plays a key role in enhancing agricultural production in Asia, particularly in rice production. Although farm mechanization is often not directly associated with yield increases, mechanizing crop production activities from land preparation to harvesting will enable early crop establishment, reduce less labor costs, ease drudgery in different activities (PhilRice, 2020) leading to higher quality of life (. Mechanization is considered a driving force for agricultural transformation, with only very specific farm operations still being carried out manually in high- and middle-income countries (Schmitz and Moss, 2015). With a focus on the PhilRice Rice Engineering and Mechanization Division workshop, this literature review aims to provide a comprehensive understanding of the factors influencing the performance assessment of such facilities.

Sustainable agricultural mechanization is defined as mechanization that is economically feasible, environmentally responsible and socially acceptable (Sims and Kienzle, 2016). The United Nations' (UN) Food and Agriculture Organization (FAO) SAM website explains on this basic concept as follows: "Mechanization covers all levels of farming and processing technologies, from simple and basic hand tools to more sophisticated and motorized equipment. It eases and reduces hard labor, relieves labor shortages, improves productivity and timeliness of agricultural operations, improves the efficient use of

resources, enhances market access and contributes to mitigating climate related hazards. Sustainable mechanization considers technological, economic, social, environmental and cultural aspects when contributing to the sustainable development of the food and agricultural sector" (FAO, 2023).

The manufacturing industry of agri-machinery is demand-driven with a limited number invested for developing new product to create a demand. Majority of agricultural machinery in the country are manufactured by small and medium-scale enterprises. Like in most manufacturing industries, agricultural machinery and equipment comes from local production and importation. Almost all of these enterprises in the industry are manufacturing more than one product line. A mixture of imported and locally manufactured tools and machines characterizes the industry, predominantly utilizing a labor-intensive production technology. Agricultural postharvest machines are either sold directly to clients by manufacturers or coursed through dealers/distributors strategically located in urban areas nationwide. Normal distribution of these machine is through the dealership network. Some manufacturers extend short-term credit lines but some sell on a combination of credit and cash basis. They only manufacture or import if there are standing orders from clients due to the high cost of the unit and the lack of capital and sources of financing. Also, due to the insufficient capital, most manufacturers are still in the cut and weld system of manufacturing. This in effect curtails the capacity of the local manufacturers to absorb new technologies to improve quality of locally fabricated machines. Along with the problem on substandard or poor-quality local steel materials, quality of locally manufactured machines is sacrificed (Calica et. al., 2012).

Custom fabrication is not commonly offered by established enterprises but rather by small service provider or backyard fabricators. Though, it is emphasized under Article 4, Section 15 of RA 10601 "Local Assembling and Manufacturing" that the concern government agency must promote and encourage the production of locally-made engines and other machinery for agricultural and fisheries purposes via partnership by the private sectors, and through joint venture agreements, however the local industry is still struggling to be more efficient and be competitive

to the neighboring counterparts. There are 322 entities that are involved in the manufacture and distribution of farm machinery in the country, 65% are comprised of importers, distributors and dealers while 35% are manufacturers and fabricators. Only 20% are classified as manufacturers that are engaged in volume production of locally developed farm machineries, and 80% are considered fabricators that produce limited volume in a per order arrangement and operate only in limited area of coverage (BAFE, 2022). Quality management standards is not popular in the industry. Only very few had integrated this concept in the manufacturing process which can lead to non-uniformity and inferior quality products. Lack of incentives also discouraged them in putting capital to upgrade its facility and conform to industry standards. Government can play crucial role in providing direction and guidance for the local industry to catalyzed and help them grow as partners in achieving prosperous farming communities.

III. METHODS AND PROCEDURES

3.1 Statement of the Problem

This study was focused on the performance assessment of the PhilRice Rice Engineering and Mechanization Division workshop. Specifically, it aimed to:

- Evaluate the workshop's effectiveness in achieving its stated goal and objectives.
- Identify the strengths and weaknesses of the workshop in terms of its facility resources, workers, and processes.

3.2 Research Design

This adopted a mixed-methods research design. This approach combines qualitative and quantitative research methods to provide a comprehensive understanding of the workshop's strengths and weaknesses. The researchers conducted in-depth interviews with workshop supervisors and workers/technicians and an observation of the workshop daily operations.

3.3 Locale of the Study

The study was conducted at the Philippine Rice Research Institute Central Experiment Station in Maligaya, Science City of Muñoz, Nueva Ecija.

3.4 Sampling Technique

A combination of random sampling and purposive sampling were implemented in this study. The respondents of the study are workshop supervisor and technicians/workers.

3.5 Respondents of the Study

The respondents of the study were workshop supervisor, technicians/workers, and clients.

3.6 Research Instruments

The data were gathered thru annual reports and feedback forms.

3.7 Data Collection

The specific tools used for data collection are described as follows:

3.7.1. Interviews

The researchers used the Key Informant Interview (KII) with the shop supervisor, support team, and selected technicians to provide valuable insights on the strengths and weaknesses of the workshop in terms of its facility resources, workers, and processes.

3.7.2. Customer Satisfaction Survey

Feedback helps gauge customer satisfaction in terms of time of completion, quality of produce, general appearance, and overall assessment of the services provided.

3.7.3. Document Analysis

A thorough examination of the workshop's daily operations was carried out through direct observations. The focus was on assessing the facility, interactions among workers, utilization of resources, and adherence to processes. Detailed notes were gathered during observations to any strengths or weaknesses. Special attention was given to identifying factors such as workflow bottlenecks, equipment malfunctions, and worker inefficiencies. By closely observing these aspects, valuable insights were gathered to better understand the workshop's operational dynamics and pinpoint areas that may require improvement.

3.8 Data Analysis

Annual reports and highlights of accomplishments were reviewed and relevant information were extracted. The result of feedback was validated and

supplement the data obtained from interviews and observations, providing a more comprehensive understanding of the case.

IV. RESULTS AND DISCUSSION

4.1. REMD Business Map

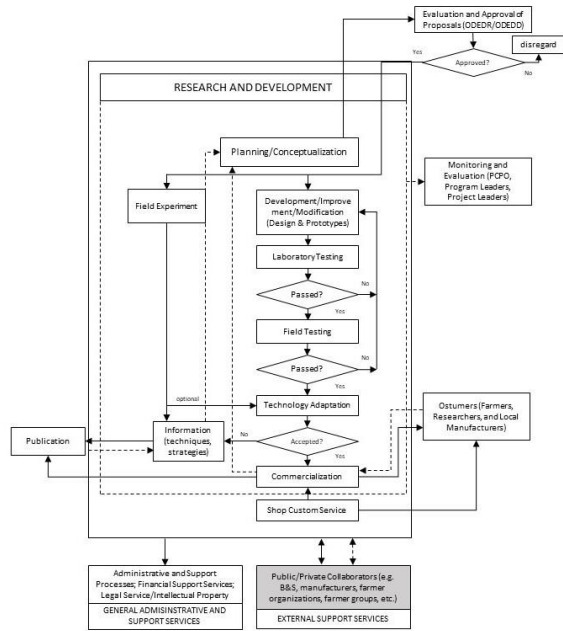


Figure 1. REMD business map.

The business plan of REMD, as presented in Figure 1, aims to provide a visual representation of the division’s strategic objectives and their interrelationships. However, the current representation overlooks the existence of the REMD workshop, leaving only the "shop custom service" displayed as one of the provided services. To improve the accuracy of the business plan's visualization, it is important to include the REMD workshop as a separate component, highlighting its role and how it contributes to the division's overall strategic objectives. The reconstruction will create a more comprehensive and coherent representation of REMD's business strategy and service offerings.

4.2. REMD Workshop Organizational Structure

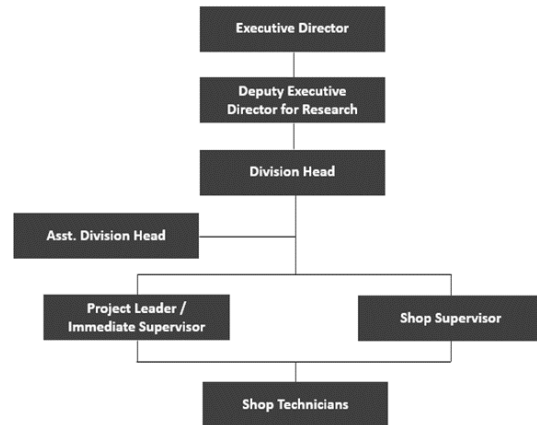


Figure 2. Current organizational structure of REMD workshop.

Figure 2 shows the current organizational structure of the REMD workshop. Management oversight shall look at and address quality assurance, staff supervision, emerging concerns, continuous improvements, and ensure that pertinent administrative support is extended in the achievement of its goal and objectives.

The Head of the REMD steer the whole operation of the workshop with the help of the Assistant Division Head. The project leader facilitates the implementation of research and development activities of their respective projects and has direct supervision of technicians under his projects. The Shop Supervisor, on the other hand is an agricultural engineer, who take charge in the overall management and technical operation of the workshop and supervise its day-to-day activities. He also guides the key personnel in strategic planning and improvements of the workshop, ensure worker safety and a safe workplace.

4.3. Workshop Service Quality Assessment

REMD workshop as a delivery unit has customer focus and open to continual improvement of its processes. It pays much attention to timeliness, and providing high quality output to its client. The two-year period of providing services gave valuable insights in the quality of service it provides. In CY2021-2022, the workshop served a total of 61 service requests of clients from various places including internal requests from researchers and

different delivery units of the institute. These services include fabrication and supply of equipment (rotary weeder, open-type carbonizer, Continuous-type Rice Hull carbonizer, and dryer components), custom fabrication, and other shop services such as bending, cutting, and rolling (Table 1).

Table 1. Services catered by the project, CY2021-2022

| Particulars | Quantity | Unit |
|---|----------|------|
| 3-ton flatbed dryer (blower and furnace) | 7 | set |
| 3-ton flatbed dryer (blower and furnace) | 1 | set |
| 8-ton flatbed dryer (blower) | 1 | set |
| 2-ton flatbed dryer (blower) | 1 | set |
| Continuous-type rice hull carbonizer | 4 | pc |
| Rotary weeder | 11 | pc |
| Open-type carbonizer | 58 | pc |
| Others (cutting, bending, custom fabrication) | 1 | lot |

It is evident from the customer feedback that the quality of service it provided is excellently done. The consolidated results in CY2021 showed that all services rendered by the workshop were rated 100% in timeliness which mean that everything is completed on time. In terms of quality of produce, 40% rated as excellent, while 60% rated it as very satisfactory. The general appearance gathered a rating of 80% very satisfactory and 20% excellent. For the overall assessment, 60% rated it as very satisfactory, and 40% excellent (Figure 3). In CY2022, client ratings showed 100% on-time delivery of services. In terms of quality of produce, 40% gave an excellent rating, while 60% rated very satisfactory. The general appearance was rated 20% excellent and 80% very satisfactory. Finally, the overall assessment of the services was rated as 40% excellent and 60% very satisfactory (Figure 4).

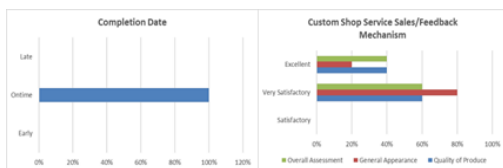


Figure 3. Customer’s feedback on workshop services, CY2021.

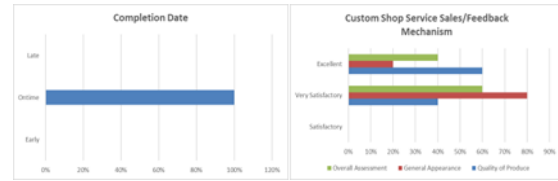


Figure 4. Customer’s feedback on workshop services, CY2022.

4.4. Supervision and Management of Shop Technicians

The PhilRice REMD workshop is comprised of a total of 15 personnel consisting of one permanent staff and 14 technicians (service contracts). As shown in Figure 2, the shop technicians work under the direct supervision of the project leader/researcher, who is responsible for assigning their work task. The shop supervisor, on the other hand, is responsible in the overall operation of the workshop, management of supplies and materials for the operation, and overseeing the shop technicians and ensuring their efficient performance and timely completion of work assignments in coordination with their immediate supervisors.

With the current set-up of the PhilRice REMD workshop, one of the problems encountered is the weak monitoring mechanism that would check if shop technicians actually delivered their tasks. In a situation, where giving work tasks to technicians falls under the project leader/researcher, the shop supervisor on the other hand has no basis to check whether the technicians are actually doing their tasks as assigned. It can lead to confusion on the part of the technicians as to whom they will follow, is it the researcher who give their tasks or the supervisor who monitor their tasks. Another weakness of the current setup is the lack of objective evaluation of the technicians at the end of every rating period since it is the researcher who evaluate and sign the evaluation of the technicians and not the shop supervisor. In this instance when the researchers are not always present in the day-to-day activities of the workers how can they have an objective evaluation on the performance of the workers. Lastly, there is jealousy among technicians which leads to unhealthy relationship among themselves as delegation of works is more often not evenly distributed among them, some are overloaded with work, while others have lighter

workloads depending on what the researchers gave them. This can impact productivity and can cause delay in project completion. Addressing this concern is crucial to ensure a balanced workload distribution among workers, optimize productivity, and enhance overall efficiency of the workshop.

4.5. Centralization of Supplies and Materials

4.5.1. Supplies and Materials

Under the current set-up, procurement of supplies and materials is under the facilitation of respective research projects, kept at common designated area with the labels of individual projects. Many instances that these supplies and materials did not come all at the same time depending on how the staff in-charge of the individual projects facilitates the process. It's more efficient if only one person facilitates the procurement of at least common supplies and materials that are good for all the projects as well as Personal Protective Equipment (PPE) being provided regularly to the workers. Over the years of fabrication activities, the following supplies and materials presented in Table 2 comprise the commonly procured items for the shop operation. They are classified as “regular” and non-regular” items.

Table 2. Matrix of supplies and materials.

| CLASSIFICATION | PARTICULARS |
|--------------------------------|---|
| Regular supplies (consumables) | Welding rod Cutting disc Grinding disc Grinding stone Bolt and nut with washer Drill bit End mill Tool bit Hand tap Momax Welding rod holder Painting supplies (paint, thinner, epoxy primer, spray gun, paint brush) Lubricants (engine oil, transmission oil, hydraulic oil, gear oil, penetrating oil, grease) Acetylene refill |

| | Personal Protective Equipment (PPE) |
|-----------------------|---|
| Non-regular supplies | 2.1 Bearing 2.2 Belt 2.3 Pulley 2.4 Sprocket 2.5 Chain 2.6 Circlip 2.7 Sensors 2.8 Electric wire 2.9 Switches 2.10 Electric plug 2.11 Outlet 2.12 Oil seal 2.13 Elbow 2.14 Tee union 2.15 End cap 2.16 Reducer cap 2.17 Nails 2.18 Tie wire 2.19 Gasket maker 2.20 Silicone sealant 2.21 Clutch Cable |
| Regular materials | 3.1 Angle bar 3.2 Flat bar 3.3 G.I. Sheet 3.4 MS Plate 3.5 G.I. Pipe 3.6 Tubular 3.7 Round bar Cold Rolled Shaft (CRS) |
| Non-regular materials | 4.1 Stainless sheet 4.1 Stainless pipe 4.3 Lumber 4.4 Plywood 4.5 Channel bar 4.6 Welded wire PVC pipe, elbow, coupling, solvent 4.8 Boiler plate 4.9 Chrome pipe 4.10 Others |

4.5.2. Issuance of Supplies and Materials

The issuance of supplies and materials is accomplished through a Requisition and Issue Slip (RIS) approved by the shop supervisor. The issuance schedule is between 8:00-9:00 am and 1:00-2:00 pm,

or as deemed necessary. Non-regular materials, which are intended for immediate use after procurement, do not need to be stored in the centralized area for safekeeping. However, a copy of the receipt will be provided to ensure proper record keeping and accounting.

4.5.3. Record Keeping

All incoming supplies and materials, as well as issuances, were recorded in a spreadsheet or equivalent platform. Additionally, copies of receipts, Requisition and Issue Slip (RIS), shop service request forms, and all related documents were compiled and kept for future reference, particularly during audits. An annual report of the REMD workshop operation was prepared and submitted which includes the following: (a) number of services rendered, (b) annual shop sales, (c) procured and utilized supplies and materials, (d) financial details, (e) status and condition of the facility and equipment, and others related to the operation.

4.6. General Maintenance of Shop Equipment

4.6.1. Equipment Maintenance Plan

Regular inspection and maintenance on the equipment were carried out by the shop technician, following the manufacturer's guidelines, adhering to recommended maintenance procedures, schedules, and specification. Cleaning of the working area and proper disposal of waste materials were carried out on a regular basis. To prioritize the safety of employees and equipment, comprehensive safety protocols were implemented, and the necessary safety equipment was provided. Routine inspections were performed to identify any potential issues, and maintenance activities were documented accordingly.

4.6.2. Upgrading of Shop Equipment

In light of the expansion of services and the aging of existing equipment, it is important to consider replacing outdated and expiring equipment in the REMD workshop. This proactive approach aims to prevent the inefficiencies and ensure the provision of timely and effective services. Table 3 shows the list of equipment being used in the REMD workshop.

Table 3. List of workshop equipment/machine.

| EQUIPMENT/ MACHINE | QTY | ACQUISITION DATE | STATUS | REMARKS |
|-----------------------|-----|---------------------|---------------|------------------------------|
| Lathe machine | 2 | 1991 | Serviceable | |
| Milling machine | 1 | 1991 | Unserviceable | For replacement |
| Hydraulic bandsaw | 1 | 1991 | Unserviceable | For replacement |
| Arbor press | 1 | 1995 | Serviceable | |
| Slotter machine | 1 | 1999 | Serviceable | |
| Milling machine | 1 | 1999 | Serviceable | |
| Bench drill | 3 | 1999 | Serviceable | |
| Hydraulic bender | 1 | 1999 | Serviceable | Spare parts outdated |
| Shearing machine | 1 | 1999 | Serviceable | Transmission cracked |
| Welding machine, 500A | 4 | 1999 | Serviceable | Outdated; energy inefficient |

| | | | |
|--------------------------------------|---|------|-------------|
| Hydraulic press | 1 | 2013 | Serviceable |
| Cutting machine | 1 | 2016 | Serviceable |
| Welding machine, inverter-type, 500A | 4 | 2019 | Serviceable |
| Manual bender | 1 | 2019 | Serviceable |
| Lathe machine | 1 | 2021 | Serviceable |

4.6.3. Shop Services Provision

The REMD workshop provide services to its clients with corresponding charges depending on the shop machines/equipment used, duration of the service, and the scope of work. After completing each work, feedback from clients is gathered through a Shop Service Feedback Form. This allows the workshop to gather valuable input and assess the customer satisfaction from the provided services. Figure 5 shows the process flowchart of availing the service.

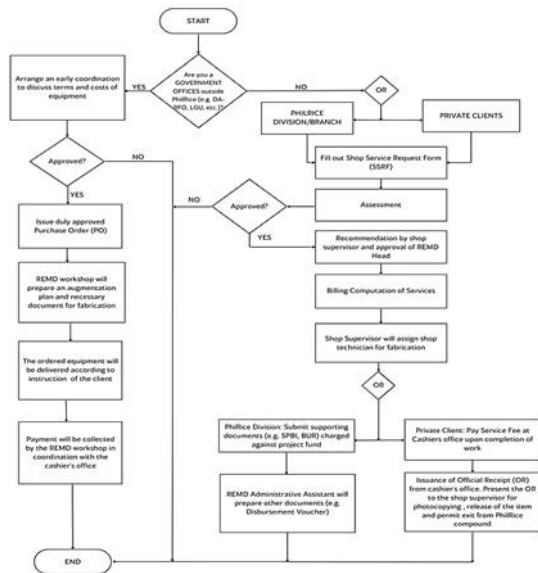


Figure 5. Process flowchart of REMD workshop.

4.6.4. Prototyping of REMD Projects

The work assignment of the shop technicians is directly given by their immediate supervisor. The shop supervisor oversees the technicians ensuring the efficient performance and timely completion of their assignments in close coordination with their respective researchers.

4.6.5. For PhilRice Division/Units/Branch Stations

Shop service requests are handled on a first-come, first-served basis, in coordination with the shop supervisor or shop support team to clarify the services being availed. The requesting party must fill out the shop service request (SSR) form, which should be endorsed by the shop supervisor and approved by the head of the REMD. Once the request is approved, the shop supervisor will assign technician/s to perform the requested work. Approved documents like Stock, Plan, and Budget Inquiry (SPBI) and Budget Utilization Request (BUR) must be submitted with the SSR form before the fabrication activity takes place. The service fee will be collected upon completion of the work and will be charged against the project fund of the requesting party. Additional documents such as Disbursement Voucher (DV) will be prepared by the Administrative Assistant of REMD in coordination with the concerned division or unit for payment processing.

4.6.6. For Private Clients

Shop service requests from private clients will be accommodated on a first-come, first-served basis, provided they are willing to pay the corresponding charges for the requested services. The client fills out shop service request (SSR) form, endorsed by the shop supervisor and approved by the REMD head. Once the request is approved, the shop supervisor will assign shop technician/s to perform the requested work. Client will pay the corresponding service fee at the cashier's office upon completion of the work. The cashier will issue an official receipt which the client should present to the shop supervisor for photocopying, release of the item, and as clearance to exit PhilRice compound for the guard on duty.

4.6.7. For Government Offices

Government offices such as Department of Agriculture-Regional Field Offices, Local Government Units, etc. can avail the shop services particularly fabrication and supply of farm equipment of their request. The concerned office must issue an approved Purchase Order (PO) to formalize the transaction provided that prior communication has taken place and agreed upon on the terms and cost of equipment. The project which the workshop operates will prepare an augmentation plan and the necessary documents for the purchase of materials needed in the fabrication. The ordered equipment will be delivered upon the instruction of the client and accepted accordingly. The workshop in coordination with the cashier's office will collect the payment and deposit it into the workshop's collection fund account.

CONCLUSION

The REMD workshop plays an important role in providing quality services. The organizational structure ensures effective management and supervision, with the Head of REMD overseeing the entire operation and the Shop Supervisor managing day-to-day activities. The workshop has received positive feedback from clients, with services consistently delivered on time and rated as very satisfactory to excellent in terms of quality and overall assessment. However, there are areas that require attention and improvement. The centralization of supplies and materials must be implemented, regular record-keeping and proper inventory management. Maintenance of equipment is conducted following guidelines and safety protocols, but there is a need to upgrade outdated equipment to enhance efficiency and productivity. The supervision and management of shop technicians should be well defined with clear assignments and close coordination with their respective supervisors. The strengths of the workshop include skilled technicians, customer focus, timeliness, attention to quality, and commitment to continuous improvement. On the other hand, weaknesses lie in limited resources, outdated equipment which hinders the workshop's full potential of better serving its clients.

RECOMMENDATION

It is recommended to make adjustments in the organizational structure of the REMD workshop as follows: The shop technicians should be placed under the direct supervision of the shop supervisor. Additionally, it is suggested to assign a shop foreman who will be responsible for the daily monitoring of shop technician activities, facilitate the issuance of RIS of supplies and materials, preparing the necessary documents on shop custom service requests, to name a few.

Under these recommendations, all technicians will be pooled and work under the close supervision of the shop foreman and guidance of shop supervisor. The worker's skill and level of competency will be the basis of task assignments. The supervisor will plan how workers are dispatched, whether it is in tandem, per operation, or per assembly, depending on the circumstances making sure that every worker has equal distribution of workloads.

Lastly, with the relevant function of the shop as a service unit of REMD, it is just time that its operation be institutionalized and allotted with regular operating fund. Currently, the shop's ability to deliver is delimited by the narrow budget that contributes to inefficiency and lower productivity. Strengthening the REMD workshop will help increase its client reach, improve the shop's performance, and maximize existing facility and pool of highly skilled personnel.

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