Educational Administration: Theory and Practice
2024,30(4), 3914-3921
ISSN:2148-2403
https://kuey.net/

Research Article

Research On Establishing Labor Norms In The Management And Operation Of Irrigation Infrastructure Managed By Hung Yen Irrigation One-Member Limited Liability Company

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Citation: Le Minh Thoa (2024). Research On Establishing Labor Norms In The Management And Operation Of Irrigation Infrastructure Managed By Hung Yen Irrigation One-Member Limited Liability Company *Educational Administration: Theory And Practice*, *30*(4), 3914-3921
Doi: 10.53555/kuey.v30i4.2145

ARTICLE INFO

ABSTRACT

Labor norms are among the essential technical-economic standards crucial in the management, exploitation, and protection of irrigation infrastructure. These norms form the basis for units to arrange labor use effectively and serve as a foundation for management levels to plan and approve public utility tasks assigned. According to the Irrigation Law and its guiding documents, establishing these norms is indeed necessary. However, currently, only a few provinces nationwide have developed these norms for grassroots irrigation organizations, including labor norms. In this paper, the authors present approaches, methods, and research results in developing labor norms for managing and operating irrigation facilities under the grassroots organizations in Hung Yen province, thereby drawing lessons for the practical deployment of this task. The research outcomes serve as lessons for the development and application of normative tools in management to enhance the effectiveness of managing irrigation facilities.

Keywords: labor norms, operation management, Hung Yen

1. INTRODUCTION

In accordance with the spirit of the Irrigation Law (Clause 3, Article 34) and the specific regulations stated in Decree No. 96/2018/ND-CP dated June 30, 2018, by the government, organizations and individuals exploiting irrigation facilities are tasked with developing technical-economic norms as a basis for pricing irrigation products and services. These norms are also used to ensure the management and operation of facilities follow proper procedures, ensuring effectiveness, safety, and protection of irrigation infrastructure. Currently, from the product and service delivery point between providers and users to the main irrigation facilities at the start point managed by provincial units, most have established technical-economic norms following the guidance of the Ministry of Agriculture and Rural Development in Decision No. 2891/QD-BNN-TL dated October 12, 2009. However, the system from the product and service delivery point to the agricultural land area under the responsibility of the organizations and individuals using these services has mostly not yet been researched for developing technical-economic norms. According to statistics from the General Department of Irrigation, Ministry of Agriculture and Rural Development, grassroots irrigation organizations across the country manage over 25,000 small irrigation facilities and more than 140,000 km of local irrigation canals.

2. APPROACH AND RESEARCH METHODS

2.1. Approach

The management and operation of irrigation facilities greatly depend on natural conditions, terrain, and the current state of the infrastructure. Therefore, to develop a set of labor norms for managing and operating irrigation facilities managed by grassroots irrigation organizations, the following approaches should be considered:

a. Based on the type of facility

Based on the list of facilities and the service scope of each, classify the facilities into categories such as

reservoirs, weirs, pumping stations, canals, etc. From there, study the regulations on managing and operating each type of facility and develop labor consumption norms (in terms of labor) for each type.
b. Based on the product from managing and operating irrigation facilities
Based on the labor consumption norms determined for each type of facility using a representative selection method, and considering the current management practices in the area and existing regulations on irrigation products and services, select an appropriate product unit to calculate labor norms for each type of facility.

2.1.1. Definition

Labor norms represent the specified amount of labor required to complete a unit of product (or a specified volume of work) adhering to quality standards under specific organizational and technical conditions. These norms encompass both detailed and comprehensive labor norms. Detailed labor norms specify the necessary labor input (from preparation to completion) needed to complete a unit of product or a certain volume of work for each job type in various processes, such as operating a sluice once, monitoring once, or conducting a patrol, according to the proper procedures, job content, organizational conditions, and technical management requirements.
Comprehensive labor norms reflect the total labor required to manage and operate a facility or a system of facilities over a season or an entire year, calculated based on the detailed labor norms.
Labor norms manifest in two forms:
Time-based norms: The maximum time allocation required to complete one unit of product (or a volume of work), meeting quality standards for one or a group of workers with appropriate professional skills under specific organizational and technical conditions.
Output-based norms: The minimum quantity of product (or volume of work) that must be completed within a set time frame, meeting quality standards for one or a group of workers with appropriate professional skills under specific organizational and technical conditions.

2.1.2. Principles of Establishing Labor Norms

The foundation for establishing labor norms includes processes, norms, and standards for managing and operating facilities; current state of the facilities and equipment; climatic and weather conditions of the irrigation area (calculated under normal conditions); and current state policies and regulations concerning labor.
Labor norms must be derived from the basic labor inputs (technological, auxiliary, and service labor) of all tasks in each process of facility management and operation, and the staffing norms for each department and management labor.
Labor norms should be rational and advanced, reflecting scientific and technical progress and advanced labor experience, and demonstrate advances in production organization, labor organization, and management.
Labor norms are developed based on job levels and should be compatible with worker grades; they ensure improved working conditions, technological advancements, and adherence to labor standards. The process of establishing labor norms should be closely linked to efforts to adjust and improve production and labor organization to enhance productivity at the grassroots level.
In calculating comprehensive labor norms for a product unit, the calculation and establishment of norms should be based on the technical specifications prescribed for the product, the product's manufacturing process, equipment operating regimes, combined with advanced experiences under widely applicable conditions, and requirements for adjusting production organization, labor organization, and management.
When establishing comprehensive labor norms, labor costs for producing by-products, major repairs of machinery and equipment, factory buildings, basic construction works, and equipment manufacturing and installation are not included. Labor costs for these types of work are established as separate comprehensive labor norms. When establishing comprehensive labor norms, units must also determine the complexity of labor and the average job level using a weighted average method.

2.2. Research Methods

To study and establish labor norms in the management and operation of irrigation facilities managed by grassroots irrigation organizations, the authors employed the following methods:
a. Analytical Method
This involves breaking down the production and labor processes into several stages and studying the factors that affect labor costs, thereby determining the labor expenditures needed to complete each task related to the management, operation, and maintenance of irrigation facilities... in accordance with proper procedures, production organization level, labor organization, and technical requirements.
b. Standard Method
This method relies on state standards and regulations to define the components of work in the management and operation of irrigation facilities.
c. Statistical - Experience Method
This aggregates and collects statistics on labor costs over one or several cycles of a type of work performed by representative units. Based on these statistics, data is analyzed and processed to validate the calculated labor norms.

d. Field Survey Method

Compile a list and service scale of each facility within Hung Yen province managed by grassroots irrigation organizations (as delegated by the Provincial People's Committee), and classify facilities based on the characteristics of each type, specifically:

- Reservoir Facilities: Categorized by capacity (cubic meters) and the machinery for operating the water intake sluices;
- Pumping Stations: Grouped by flow rate (cubic meters per hour);
- Weirs: Classified by height (meters);
- Canals: Grouped by the width of the canal bed (meters).

For each group of facilities, select representative facilities (in terms of technical parameters, facility characteristics, and service scale) to conduct detailed surveys of management and operation tasks.

3. CURRENT STATUS OF THE CONSTRUCTION SYSTEM

3.1. Electric pumping station

The company currently has 704 pumping stations with 1,337 pumps of all kinds (details are as follows:)

Table 2.1. Company pump summary table

Unit: Machine

No.	Machine type / Enterprise	<1000 (m³/h)	1000-1400 (m³/h)	1500-<4000 (m³/h)	≥4000-8000 (m³/h)	≥8000 (m³/h)
1	Phu Cu	21	68	34	9	5
2	Kim Dong	32	20	113	13	0
3	Yen My	25	70	43	2	5
4	My Hao	26	28	40	52	0
5	Hung Yen City	15	8	27	10	6
6	An Thi	54	31	117	36	2
7	Chau Giang	72	54	78	3	20
8	Van Lam	34	20	31	12	0
9	Tien Lu	15	12	38	11	25
	Total	**294**	**311**	**521**	**148**	**63**

Channel system

The entire Company currently manages a total of 2,109.29 km of irrigation and drainage channels, including 1,548.63 km of earthen channels and 560.66 km of concrete channels, divided according to the following management units:

Table 2.2 Summary table of the channel system

No.	Unit Name	Total length of earthen channels (km)	Total length of concrete channels (km)	Total (km)
1	Phu Cu	101	47	149
2	Kim Dong	298	30	328
3	Yen My	192	16	208
4	My Hao	100	25	124
5	Hung Yen City	84	29	113
6	An Thi	297	19	317
7	Chau Giang	134	318	452
8	Van Lam	125	44	168
9	Tien Lu	218	32	250
	Total	**1.549**	**561**	**2.109**

Sewer system

The Company currently has 3,330 drains (V0 and above) and 28,792 infield drains

2. Technical Procedure for Constructing Labor Standards

2.1. Process of Constructing Labor Standards

Labor standards are the necessary labor costs (from preparation to completion) to accomplish a unit of product or a certain amount of work according to specific technical standards and quality under certain organizational and technical conditions. To develop labor standards, it is necessary to identify and divide the management process of water management facilities into stages:

Stage 1: Production stage aims to create a water source to serve irrigation/drainage tasks. Corresponding to this stage, labor standards need to be developed for operating the main facility or water collection tasks for the Hung Yen Water Management Limited Liability Company.

Stage 2: Circulation and distribution stage act as a bridge between production and consumption. The circulation process begins from the water intake gate at the main facility (or water collection point), water flows through various channels and is directed to the fields of producers. Labor standards need to be developed for managing canal systems and structures on the canal.

Stage 3: Consumption stage is the final stage in the production-circulation-consumption cycle. Water is delivered to the fields to ensure irrigation over a large area without wastage. This stage requires labor standards for irrigation management.

Labor standards include: i) detailed labor standards, which are the labor costs required to complete a specific amount of work for each task group in each stage (one time of culvert operation, one time of observation, one time of maintenance, etc.) according to the correct process, job content, and technical management requirements, and ii) aggregated labor standards, which are the labor costs required to manage and operate a facility or system per unit of product for each season or the entire year.

2.2. Sequence of constructing labor standards

Diagram 1: Sequence of developing labor standards for hydraulic organizations

Step 1: Consolidation of infrastructure classification (statistics, synthesis, classification, and grouping of infrastructure). The infrastructure managed by basic irrigation units includes: reservoirs, small dams; pumping stations; water intake culverts, and small area zones as specified by the People's Committee of Hung Yen Province.

Step 2: Developing detailed labor standards: i) Division of labor processes and labor classification (according to 3 stages: production, circulation-distribution, consumption); ii) Developing detailed labor standards for 4 main job groups (monitoring, operation, maintenance, inspection and protection) in each stage;

iii) Consolidating detailed labor standards by main job groups in each stage.

Step 3: Developing comprehensive labor cost standards: Calculating comprehensive labor costs for the management and operation tasks of each type of infrastructure (reservoirs, dams, pumping stations, culverts, canals and structures on canals, field management) for each crop season and the entire year based on the total number of tasks performed for the 4 main tasks: i) Operation tasks; ii) Monitoring tasks; iii) Maintenance tasks; iv) Inspection and protection tasks.

Step 4: Calculating comprehensive labor standards: Calculating the total labor effort determined annually for each type of infrastructure based on the volume of products that representative structures are selected to serve for each season or the entire year.

Consolidation of infrastructure classification

Statistics, synthesis of infrastructure managed by the unit (reservoirs, pumping stations, culverts, main dams, various types of canals and structures on canals, opening and closing devices, ...).

Classification and grouping of infrastructure: Based on the infrastructure data, arrange and classify the infrastructure according to functionality and technical specifications. For example, pumping station groups are classified by pump flow rates such as 1000 m3/h, 2500 m3/h, 4000 m3/h, ...; culvert groups are classified by culvert dimensions BxH (or by opening and closing devices); canal groups are classified by channel bottom width, constructed canal, and earthen canal, etc. Compile summary tables by groups and by management units (teams, clusters of stations, enterprises, ...).

2. Developing detailed labor standards

a) Division of labor process and classification of labor

Division of labor process:

Based on the management and operation process, the labor process is divided into three main stages:

management and operation, and protection of main structures; management and operation, and protection of canals and structures on canals; and management of fields. In each stage, there are four main types of work: operation of structures; inspection and monitoring tasks; maintenance tasks; and protection tasks. The content of these tasks in each group is carried out according to the management and operation regulations. A unit managing the exploitation of hydraulic structures is considered a type of material production enterprise, and although it has its own characteristics, the production process also includes three stages: Production; Circulation and distribution; and Product consumption.

Stage 1 (Production stage): Management and operation of main structures to produce irrigation and consumption water (produce products). This stage includes tasks such as managing and operating main structures like pumping stations, reservoirs, culverts, dams, etc.

For reservoirs, the labor process involves operating the reservoir to store water according to the process. To store water, tools and equipment (culverts, dams, etc.) must be used. When there is a need for water supply, the culvert is opened (water is released) to transfer water into the distribution canal and distribute it downstream to water users. For pumping stations, the production stage involves pumping water into the canal when there is a demand for water. The labor force in this stage includes workers managing and operating various structures in the main area.

Stage 2 (Circulation and distribution stage): This stage acts as a link between production and consumption. The circulation process starts from the water intake gate at the beginning of the main canal of the reservoir and pumping station. Water flows through the main canal, primary and secondary canals, to the head of the tertiary canal. When the water reaches the foot of the users' fields, the circulation process ends. This stage includes tasks such as operation of structures, water conveyance, regulation, and distribution.

Stage 3 (Product consumption stage): Field management (product consumption). Water is transferred from the supplier to the consumer. When water reaches the areas and fields, distribution to the secondary canals must be managed to ensure irrigation over a large area without waste. These tasks are coordinated with local agricultural forces to manage and distribute water to the end users. This stage includes tasks such as area irrigation, crop types, water distribution planning, water usage contracts, and irrigation results assessment.

Once the job content is determined, a survey is conducted to develop detailed labor standards for each task group in each stage.

To calculate the labor cost, the work time structure for each stage must be determined, followed by the application of suitable methods to measure labor consumption for each task.

Managing the exploitation of hydraulic structures involves various types of tasks with different characteristics. Managing the exploitation of hydraulic structures is highly complex, involving both technical and manual labor and heterogeneous job characteristics. To optimize labor utilization, one worker may have to perform various tasks with very different requirements.

Classification of labor:

The classification of labor involves dividing labor into technological labor, auxiliary and service labor, and management labor to determine labor time consumption standards for each type, serving as the basis for determining comprehensive labor standards for the unit's products.

The classification of labor must be based on the nature of the industry, production organization, and labor organization of the unit managing the exploitation of hydraulic structures. Different production and labor organization conditions result in different labor classifications, so the unit must have a system of criteria for evaluating and classifying labor appropriately.

Labor in the units managing the exploitation of hydraulic structures is classified as follows:

i) Technological labor: These are workers directly involved in managing and operating hydraulic structures according to technological processes to ensure the system's capacity to serve irrigation and water supply needs. Technological labor also undertakes other related tasks to ensure the safe and efficient operation of the system. The main content of technological labor in managing and operating various types of hydraulic structures includes four main tasks: monitoring, operation, maintenance, and inspection. Field work is considered technological labor when it is associated with the management and operation process of the entire hydraulic structure, from the facility to the field.

ii) Auxiliary and service labor: These are workers who do not directly perform technological tasks but serve to support technological labor in completing the production process. Auxiliary and service labor are determined based on functions and serving tasks, such as: technology organization, technology support, equipment maintenance, production and maintenance of tools, technical inspection, transportation and handling, energy supply, warehouse services, workshop and infrastructure maintenance, occupational safety and health protection, technical safety, and industrial hygiene, etc.

iii) Management labor: This refers to the labor force in management positions to manage and oversee the production processes of the units.

Once the job content is determined, a survey is conducted to develop detailed standards for each task group.

b) Determination of work time structure:

The work time structure includes standard time, service time, and non-standard time.

Standard time:

- Standard time is the direct time used for management, operation, maintenance, and protection of hydraulic

structures, including main and auxiliary work time.
- Main work time: Continuous time spent by workers on tasks, such as pump operators, conduit operators, etc.
- Auxiliary work time: Time required to perform main tasks, such as travel time from the office to the site, etc.

Service time:
- Actual time required for workers to perform job-related tasks, workplace activities during work hours, such as tool issuance, machine cleaning, etc.
- Technical downtime: Time for tasks with specific interruptions in the technological process where workers are required to stop working due to technical conditions, such as when the pump operates beyond technical limits, engine temperature is too high, etc.
- Preparation and completion time: Time spent preparing for work and completing tasks, such as job orientation, receiving production instructions, checking the site, starting equipment, etc.
- Rest and natural needs time: Time required for workers to rest and meet natural physiological needs.

Non-standard time:
- Unreasonable work time: Time spent by workers on tasks outside their scope, such as assisting other tasks, reporting violations, etc.
- Organization-induced waste time: Time when workers are idle due to organizational or technical reasons, such as waiting for power restoration, fuel delivery, etc.
- Worker-induced waste time: Time spent by workers not adhering to labor discipline or making mistakes in production, not accounted for in the standards.

c) Time consumption measurement methods:

To determine the aforementioned types of time in a worker's workday (or shift) or work process in managing and operating hydraulic structures, time consumption measurement is conducted. There are three methods to measure time as follows:
- Photography method: Study all types of time consumption during the day and during the work process. This method, also known as on-site observation, uses clocks to study worker time consumption.
- Stopwatch method: Only study time consumption in each action of short-cycle work processes.
- Statistical time synthesis method: Only study time consumption in two synthesis parts: necessary time consumption and loss time. This method is abbreviated as "statistical time method".

Measuring tools include a stopwatch when using timing methods or photography, or a clock with hands when using time statistical methods. During the time measurement process, the following documents must be recorded: data on each type and part of time consumption for specific tasks; data on the number of operations or products achieved during the monitoring period for each type of task; and detailed characteristics of the management stage being monitored.

To ensure completeness and a certain level of accuracy of these documents, the time measurement process must go through the following steps: preparation; conducting time measurement; and adjusting the results of time measurement. To ensure the relative accuracy of the measurement method, we must ensure the number of measurements, the duration of each measurement, and the total duration of all measurements for the work process for each task in each management stage.

d) Determination and calculation of technological labor standards (Tcn)

Technological labor standards (Tcn) in detail for the management of hydraulic structures include four main tasks: protection work; monitoring work; operation work; and maintenance work. The work content and technical requirements in management and operation of hydraulic structures are determined according to the specific management and operation regulations for each type of structure.

Detailed labor standards are determined using the method of measuring the time required to complete a task based on monitoring the work process of workers, according to the stipulated working time units. Working time is the duration of a day (or a shift) according to the current regulations of the state.

Tcn is equal to the total standard time of the main worker performing the basic tasks according to the technological process and the tasks to produce that product under determined organizational and technical conditions.

e) Developing detailed labor standards for main task groups in each stage

Direct labor hour standards for specific task contents are determined based on surveys, timing according to management and operation procedures, or statistical experience.

For example, constructing detailed labor standards for managing the operation of a pumping station:

To calculate labor costs for the management of pumping station operations, it is necessary to first determine the content of the tasks to be performed in the work stage.

Maintenance work must be carried out regularly, including all structures and equipment belonging to the pumping station such as water conduits, sumps, pump stations and pumping machinery, discharge tanks and downstream conduits, transmission equipment, substations, and transformers.

According to the actual situation, security personnel are deployed day and night outside the operating hours

of the facility.

5. CALCULATION RESULTS AND DISCUSSION

5.1 Calculation Results

Based on the current status of the classified construction system, following the procedure and sequence of implementation, the research group developed standard indicators for each group and type of construction based on the results tables:

Labor standard calculation results for the entire company.

No.	Workforce Categories:	Average per whole company (tons/hectare)
1	Technological Labor (Tcn)	198.820
1.1	Facility Operation Management Workers:	158.619
+	Labor for sluice operation management	24.158
+	Labor for pump station operation management	134.461
1.2	Irrigation Workers:	40.201
+	Labor for canal and ditch operation management	12.189
+	Labor for field irrigation management	28.012
2	Administrative Labor (Tql)	24.520
3	Support and Auxiliary Labor (Tpv)	46.930
-	Total:	270.270
-	Converted Area	**94.504**
-	Labor Norms:	**2,86**

5.2. Some Discussions

The labor norms established for each type of facility, based on groups of technical parameters, provide a basis for management units to determine the total labor costs for the management and operation of facilities within their purview. These norms also serve as a basis for allocating cost items such as salaries for operational management staff based on the volume of work performed. Additionally, labor norms, along with other cost components, are used to set the prices of products and irrigation services for local users, which form the basis for agreeing on pricing levels for these services.

To implement these labor norms in facility management, it is essential to identify the technical parameters of the facilities and the basis for determining these parameters. In the context where many irrigation facilities managed by grassroots irrigation organizations have been constructed a long time ago and many do not have clear technical specifications—operating entirely based on the experience of the managers—applying these norms presents a significant challenge to facility management levels.

Currently, the management and operation of irrigation facilities by grassroots irrigation organizations are mostly assigned to local officials who also serve in other capacities such as local police, women's associations, veterans' associations, youth unions, village heads, and local government bodies. Therefore, most do not possess specialized expertise in facility management, which can significantly impact the efficiency of facility operations. In Hung Yen, there has been a strong collaboration between the Hung Yen Irrigation One-Member Limited Liability Company and district and commune-level irrigation management units through specialized training sessions on management and operation. Additionally, district officials regularly exchange and assess the actual situation to enhance the operational effectiveness of facilities from the main units to the fields.

3. CONCLUSIONS AND RECOMMENDATIONS

The management and operation of irrigation facilities have been progressively refined in terms of institutional and policy frameworks since the enactment of the Irrigation Law. In reality, the management and operation of irrigation facilities by organizations such as Single-Member Limited Liability Companies are mostly established based on technical-economic norms. For grassroots irrigation organizations, which are heavily influenced by natural conditions, socio-economic characteristics, and the customs, traditions, and culture of each region, management methods and processes also need to be flexible. However, currently, besides the state-supported pricing system for irrigation products and services from the point of product and service delivery to the main facilities, the activities of grassroots irrigation organizations require contributions from water users. This significantly affects the efficiency of managing and operating the facilities, as it is challenging to secure funding for maintenance and repairs as per technical requirements. Developing technical-economic norms that suit the regional characteristics and meet technical requirements for the systems managed by

grassroots irrigation organizations is essential to gradually align management practices with universal standards.

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