



DOI: 10.22620/agrisci.2018.24.008

**ALGORITHM FOR CALCULATION AND ANALYSIS OF LABOUR REMUNERATION  
IN THE AGRICULTURAL SECTOR****Delyana Dimova, Vanya Georgieva\***

Agricultural University – Plovdiv

**\*E-mail: v.georgieva@au-plovdiv.bg****Abstract**

There are various applicable payment systems for labour remuneration in the agricultural industry. They vary upon the heterogeneous staff categories – managers, analysts, field specialists, machine operators, qualified personnel, low-skilled personnel. Similarly, remuneration systems could be different for full- and part-time employees.

In the current paper, we argue that it is employers who choose the most efficient remuneration system based on their own interests and law regulations. By reason of clarity with respect to salary formation, the remuneration systems in operation must be well-declared and comprehensible to workers, which is practically not always the case. This situation undoubtedly causes conflicts in the work environments on the one hand and obstructs the motivational function of the remuneration system on the other.

The aim of our paper is to present an algorithm for calculation and analysis of remuneration based on personnel classification according to the prevailing pay systems: time rate, piece rate or a combination of both.

In conclusion, we consider that the suggested algorithm for salary calculation and management is easily applicable to organisations in the agricultural sector and could readily contribute to the optimization of payment.

**Keywords:** algorithm, labour remuneration, analysis, agricultural sector, Bulgaria.

**INTRODUCTION**

Agricultural labour has an important role in Bulgarian economy considering the fact that 1/5 of all workforce is engaged in the Agricultural sector (www.nsi.bg, 2018). Nevertheless, the offered working conditions do not rank as most attractive. The work is hard and very often executed under heavy conditions, wages are among the lowest in the national economy, and the unregulated labour share is extremely high. In addition, workers often lack other alternatives which lead to a negative effect, due to their professional qualification, skills and knowledge, region specificity (http://www.fnsz.org, 2015).

The characteristics of the Agricultural sector, the nature of the labour process and the sector employees set a series of challenges before the employers when choosing measures and mechanisms to improve the situation (Georgieva, 2012). Motivation is required for attracting people to the working process. The labour input must ensure remuneration corresponding to the employees' needs. At the same time, labour should be a factor for high production efficiency and ensure the achievement of good economic results for the business. The question about the proper definition of remuneration is, undoubtedly, the most important issue in this process (Blagoeva, 2009).

There are various remuneration systems in the agricultural sector. They differ upon the heterogeneous staff categories – managers, analysts, field specialists, machine operators, qualified personnel, low skilled personnel. Remuneration systems could be different for full- and part-time employees.

The time rate system is applicable to the category of staff where the amount of labour is difficult to assess – managers, analysts, field specialists. It is also widely used for part-time employees. The wage is calculated on a man-hour or man-day basis. The possibility to control employees' working behaviour is viewed as an advantage of this system, while its major drawback is the lack of quality and quantity stimuli for the invested workload.

The piece rate system also finds wide application in the agricultural sector both for full- and part-time employees. Its implementation involves designing a unit of work rates. Labour productivity stimulus is viewed upon as an advantage.

The mixed payment systems combine elements from both the above-mentioned systems. These are built on the controlled correlation basic salary/implementation rate of labour standards (Vladimirova, 2009).



Time bonus rate system is also widely used, where an additional bonus is calculated to the agreed basic salary (gratuity). The grounds for those benefits come from: extra man-days or hours; generated savings; working processes accomplished ahead of schedule; high yield results; etc.

It is employers who choose the right remuneration system based on their own interests and law regulations. By reason of clarity on salary formation, remuneration systems must be well declared and comprehensible to workers, which is practically not always the case.

This situation causes conflicts in the work environment on the one hand, and on the other – acts obstructively to the motivational function of the remuneration system.

The aim of the current paper is to present an algorithm for calculation and analysis of the remuneration applicable to contemporary Bulgarian agriculture.

The following tasks have been set for achieving this goal:

- featuring the applied systems for calculation of labour in agriculture;
- defining and describing the algorithm components;
- analysing the necessity and advantages of its application in practice.

## MATERIALS AND METHODS

The developed algorithm combines different systems for labour remuneration and includes the following components:

- *"Working hours" Module*-information is entered about working hours for each employee and worker (actual working time, leaves, sick leaves, training).
- *"Workload" Module*-every employee's workload is reported. This module is used only for staff categories where the accomplished work corresponds to a quantitative assessment. This information is applied to the other modules to calculate employees' wages according to the pre-set regulations. The present module sources information from the *"Working hours" Module* for calculating the workload towards the time employees spend on their working stations. The *"Workload" Module* provides the opportunity to: describe all elements (operations, stages, phases, etc.) of the tangible production process, standardize and report each of those elements – together or separately.

- *"Remuneration" Module* – the calculation of gross remuneration, social security payments and taxes, and net remuneration are based on preliminary introduced requirements for basic salary estimation.
- *"Analysis and reports" Module*- reports from different analytical sections are presented. Different indicators, short- and long-term tendencies could be monitored.

The input data for the algorithm is extracted from the company's primary documentation (Register of attendance; Work report; etc.). The information from these documents is entered in separate tables. It is applied in both *"Working hours"* and *"Workload"* Modules for calculating the following indicators:

- A number of work-days ( $S_1$ ) – the time duration while the personnel have actually been at their work station accomplishing their work tasks.

$$S_1 = \sum_{i=1}^n x_i, (1)$$

$x_i$ - the respective day from the month,  $n \in \mathbb{N}$ ,  $n \leq 31$ ;

- A number of holidays ( $S_2$ ) – includes the days when the employees are on leave. According to the Bulgarian legislation, the leave could be: paid (20 working days throughout the year), additionally paid leave (in cases of exceeding legal working hours or bad working standards), unpaid leave and other specific types of leave (for trainings, creative leave, etc.) (Labour Code, www.nap.bg).

$$S_2 = \sum_{i=1}^{p1} y_i, (2)$$

$y_i$ - the respective day from the leave,  $p1 \leq n$ ;

- A number of days for sick leave ( $S_3$ ) - includes the days when employees are unable to accomplish their work tasks because of health problems. Bulgarian legislation requires at least 6 months of service for an employee's sick leave eligibility. The first 3 days of the sick leave are paid by the employer – the amount equals to 70% of gross salary. The rest of the days are paid by the National Social Security Institute (Social Security Code, www.nap.bg).

$$S_3 = \sum_{i=1}^{p2} z_i, (3)$$

$z_i$  - the respective day from the used sick leave,  $p2 \in \mathbb{N}$  and  $p2 \leq 3$ ;

- Total workload of the same kind ( $Q$ ) – not every activity could be quantified.



$$Q = \sum_{i=1}^t r_i, \quad (4)$$

$r_i$  - workload for a single work-day,  $t \leq n$ ;

This indicator appears in the second module – “Workload”, while the first three indicators are included in the “Working hours” Module.

The third module – “Remuneration” depends on the remuneration system chosen by the company. This module includes the following indicators:

- Remuneration for the total man-hours of all workers and employees ( $A_1$ ),

$$A_1 = \sum_{i=1}^n w_i, \quad (5)$$

$w_i$  - remuneration for work-hours accomplished by a single worker or employee,  $n \geq 1$ ;

- Remuneration for the total time of service of all employees and workers ( $A_2$ )

$$A_2 = \sum_{i=1}^n v_i, \quad (6)$$

Where  $v_i = w_i \cdot g_i \cdot k_i$ ,  $v_i$  - remuneration for a single worker or employee,  $g_i$  - years of service,  $k_i$  - % set for the specific company,  $n \geq 1$ ;

- Remuneration for legal working hours ( $A_3$ )

$$A_3 = \sum_{i=1}^n r_i \cdot c_i, \quad (7)$$

$c_i$  - remuneration for the accomplished type of work;

It is possible to include other elements, as well, depending on the specifics of the company.

- Gross remuneration for all workers and employees represents the total sum of all remuneration elements (Labour Code, www.nap.bg).

$$A_4 = \sum_{i=1}^n b_i, \quad (8)$$

where  $b_i = w_i + v_i + (r_i \cdot c_i)$  - Total remuneration for the  $i$  - worker or employee;

- Social security payment- shared by the employer and employee. Social security legislation regulates the percentage each must pay (Law on State Social Insurance Budget for 2018, www.nap.bg).  
a) by the insurer ( $L_1$ )

$$L_1 = \sum_{i=1}^n H_i, \quad (9)$$

where  $H_i = b_i \cdot f_1$  - social security instalment for the  $i$  - worker or employee,  $f_1$  - percentage,  $L_1$  - the total sum of social security instalments;

b) by the insuree (staff member)

$T_i = b_i \cdot f_2$  - social security instalments for the  $i$  - worker or employee,  $f_2$  - percentage,

$$L_2 = \sum_{i=1}^n T_i, \quad (10)$$

$L_2$  - total amount of social security instalments for insurees;

- Income tax - personnel due; its percentage is set by the country-specific tax legislation. (Income Tax of Individuals, www.nap.bg).

$D_i = (b_i - T_i) \cdot f_3$  - tax for the  $i$  - worker or employee,  $f_3$  - percentage.

$$L_3 = \sum_{i=1}^n D_i, \quad (11)$$

$L_3$  - total income amount;

- Net remuneration - this is the distinction between gross remuneration and deductions (taxes, insurances, etc.) (Labour Code, www.nap.bg).

$N_i = (b_i - T_i - D_i)$  - remuneration for the  $i$  - worker or employee

$$L_4 = \sum_{i=1}^n N_i, \quad (12)$$

$L_4$  - the total amount of net remuneration for all workers and employees.

The “Analysis and reports” Module carries out references tailored to the management needs. The results could be compared (Dimova, Georgieva, 2014), analysed and visualized via MS Excel (Mihaylov, 2016).

The algorithm enables users to insert new calculation modules for any newly added economic indicators.

## RESULTS AND DISCUSSION

The input data for the algorithm are entered in *xlsx* files. The example below displays information about 5 staff members in two consecutive months - their position in the company, daily man-hours, days spent on leave or sick leave. The first group of indicators are calculated applying formulas (1) - (3) from the “Working hours” Module. The indicators are displayed in 3 columns in Table 1.

Data regarding the type and quantity of daily workload must be inserted in a separate *xlsx* sheet. It should be noted that a single team member is able to complete several types of activities for one month. The example below includes activities such as ploughing, sowing, fertilizing, harvesting, etc. With a view to simplification, there is a number (code) (Dimova, Onkov, 2007) corresponding to each work type. The payment for each work type is also pre-set. The workload for each type (Table 2) is calculated via the formula (4) from the “Workload” Module. Only the tractor-operator work activity could be



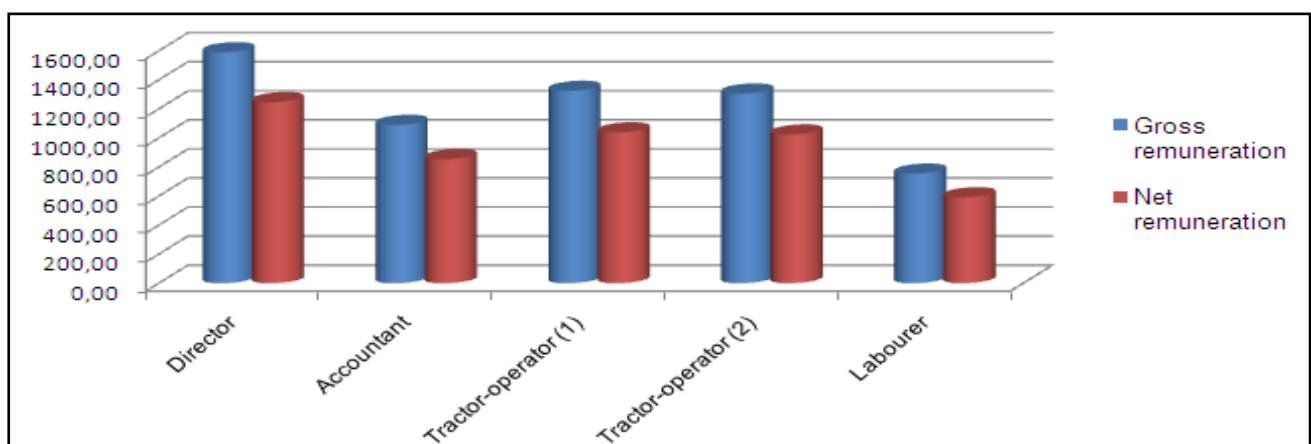
Remuneration is defined on a length-of-service-and-hours-of-work basis for some staff members. For other members of personnel, whose workload can be quantified, remuneration also includes the sum of legal working hours. It depends upon the type and quantity of the accomplished work (formula 7). In the example, the staff remuneration whose labour cannot be quantified is based on accomplished hours. Both employers and employees agree upon its full-time rate. The latter represents the so-called basic salary. Staff remuneration, whose labour can be quantified, includes a constant share - remuneration for accomplished hours and additional remuneration. Additional remuneration share is based on the degree of labour input. Its type and share are specified by the company. The big relative share of the gross salary additional remuneration stimulates staff members to increase the amount of labour input. Table 3 shows calculations of staff remuneration.

The "Analysis and reports" Module presents various reports based on data processed in the two preceding modules. These reports include information about:

- Hours of work accomplished by each staff member within a definite period. The present example refers to the respective company staff and generalizes data for two consecutive months (Table 4).
- received remuneration (gross and net) for the indicated time interval. The graphics data representation allows a considerably faster analysis. In this case, the remuneration allocated to both tractor operators for the chosen month is much higher compared with that for the other two staff categories (accountant, labourer) (fig. 1).
- the accomplished work by a specific staff category within the limits of the indicated period. This allows analysis of the work of each staff member, reporting its productivity and the comparison with the other workers. This report could also be used in the formation of the expenditure norms for the different types of work. Table 5 visualizes the number of days for ploughing, disc harrowing and sowing.

**Table 4.** Staff availability/absence by months

Name, Surname	Position	Month 1	Month 2	Holidays	Sick leave days
		Man-days	Man-days		
Maria Ivanova Petrova	Director	23	15	8	0
Maya Marinova Stoyanova	Accountant	23	23	0	0
Petar Vassilev Petrova	Tractor-operator	23	23	0	0
Stoyan Vassilev Timov	Tractor-operator	23	23	0	0
Simeon Panev Tanev	Labourer	23	20	0	3



**Fig. 1.** Visualization of the results for gross and net remuneration



**Table 5.** Data about the work accomplished by the staff

Name, Surname	Position	Month 1		Month 2			
		Ploughing	Number of days	Disc harrowing	Number of days	Sowing	Number of days
Petar Vassilev Petrov	Tractor-operator	889	23		23		
Stoyan Vassilev Timov	Tractor-operator	861	23	687	5	2109	18

## CONCLUSIONS

1. The current paper presents an algorithm for calculation and analysis of labour remuneration. It is based on personnel grouping according to the following remuneration systems: time rate, piece rate or a combination of both.

2. For staff members, whose work cannot be easily quantified we suggest:

- breaking up the work blocks into separate work activities;
- determining a value indicator for each work activity;
- determining the contribution of each work activity when setting labour remuneration;
- executing the work activity within a pre-set time frame;
- daily data inserting with a view to activities accomplished by the worker.

3. Reporting those indicators increases the complexity of salary calculation, thus achieving better coordination between the interests of both employers and employees. The raise or decrease of individual salary depends on employee's qualification, individual productivity and work motivation.

4. The contribution of this research could be summarised in the following areas:

- demonstration of specific characteristics in salary calculation for the agricultural sector is an important factor for its effective management;
- easy application of the offered algorithm for remuneration calculation and analysis, and support to the payment process optimisation in the agricultural sector.

## REFERENCES

- Blagoeva, N.*, 2009. The income as an element of the financial theory, practice and legislation, Annual almanac, Scientific research almanac of PhD students, Academic publishing of Academy of economics "D. A. Tsenov" Svishtov, v. 2.
- Dimova, D., V. Georgieva*, 2014. The application of MS EXCEL in some aspects of the economic analysis, scientific journal Economics and finance, 27.06.2014, Dnepropetrovsk, Ukraina, pp. 74–76.
- Dimova, D., K. Onkov*, 2007. An algorithm for automated creation of a PC database storing related text objects, Information technologies and control, №2/2007, pp. 48–52.
- Georgieva, E.*, 2012. Legal regulations in support of the agricultural producers in Bulgaria. Plovdiv, Scientific works, vol. LVI, Academic Publishing House of Agricultural University Plovdiv, pp. 227–232.
- Mihaylov, D.*, 2016. Excel 2013, New star, Sofia.
- Vladimirova, K.*, 2009. Economics of Labour, Sofia: Siela.
- Employment and accomplished hours at a national level, Macroeconomic Statistics, 2018, [www.nsi.bg](http://www.nsi.bg)
- Economic realization of the labour factor in modern Bulgarian agriculture, Sofia, 2015, [www.fnsz.org](http://www.fnsz.org)
- Income Tax of Individuals, In force since 01.01.2007. As published in State Gazette, Nr. 95 of 24.11.2016, [www.nap.bg](http://www.nap.bg)
- Labour Code. In force since 01.01.1987. As published in the State Gazette, Nr. 26 of April 1<sup>st</sup> 1986 r. and State Gazette, Nr. 27 of April 4<sup>th</sup> 1986, [www.nsi.bg](http://www.nsi.bg)
- Social Security Code. In force since 01.01.2000. As published in the State Gazette Nr.110 of December 17<sup>th</sup> 1999, [www.nsi.bg](http://www.nsi.bg)
- Health Care Insurance Act, As published in the State Gazette Nr.70 of June 19<sup>th</sup> 1998, [www.nsi.bg](http://www.nsi.bg)
- Law on State Social Insurance Budget for 2018. In force since 01.01.2018. As published in State Gazette, Nr. 99 of 12.12.2017, [www.nsi.bg](http://www.nsi.bg)