

Automation of Real-Time Managerial Accounting in Agricultural Enterprises During Sowing and Harvesting Seasons

Golova E.E.*

Department of Economics, Accounting
and Financial Control
Omsk State Agrarian University
named after P.A. Stolypin (Omsk SAU)
Omsk, Russia
ee.golova@omgau.org

Gapon M.N.

Department of Economics, Accounting
and Financial Control
Omsk State Agrarian University
named after P.A. Stolypin (Omsk SAU)
Omsk, Russia
mn.gapon@omgau.org

Baranova I.V.

Department of Economics, Accounting and Financial Control
Omsk State Agrarian University named after P.A. Stolypin (Omsk SAU)
Omsk, Russia
iv.baranova@omgau.org

Abstract — All areas of the agricultural sector, including the processing industry in the field of crop production, are currently being actively automated. Financial accounting as a provider of data for managerial decision-making plays an important role in the activities of all agricultural enterprises, that is why its data processing technologies need improving. The analysis of the studied automated systems showed that they do not always satisfy all the needs of agricultural enterprises, since they cannot provide data on such agricultural work as harvesting and sowing. Therefore, the role and need for changing approaches to the automation of managerial accounting in agriculture are increasing. The authors propose to provide the 1C system with additional functions, which will allow enterprises to regularly receive data that are most important to them during harvesting and sowing seasons and will allow the enterprise management to make informed decisions to increase the intensity of work and optimize the timing of their implementation. The authors' recommendations can be used both by agricultural enterprises and regional suppliers of automated services.

Keywords — automation, agriculture, managerial accounting, crop production, financial accounting.

I. INTRODUCTION

Relevance of the study. Modern realities of the development of the domestic economy necessitated digitalization in almost all sectors, which is evidenced by the development of state program documents aimed at economic growth in the country. The priorities of the strategic development of the Russian Federation are stated in the National Projects adopted in 2018, among which the Digital Economy project, which is focused on a wide range of problems to be addressed in the near future, is of great relevance. One of the most urgent tasks in this project is 'the transformation of priority sectors of the economy and social sphere ... through the introduction of digital technologies and platform solutions' [5]. In our opinion, it is the automation of

business processes, as the first stage of digitalization, which will not only increase the efficiency of production activities (therefore, ensure economic growth), but also guarantee domestic producers the opportunity to increase their competitiveness. All of the above can be fully applied to an important agricultural industry, where the demand for the latest initiatives to improve management through automation is currently increasing.

Managerial decisions in the agricultural sector are often based on the analysis of financial accounting, which lacks a holistic picture of enterprise functioning and does not allow full evaluation of the prospects for its development. In this regard, introduction of managerial accounting is one of the most effective solutions to such problems. Many leaders have already taken this path, but have not obtained the desired result. This is due to a high level of requirements for the efficiency of data collection and a large amount of data to be rapidly processed. Therefore, practice shows that the use of elements of managerial accounting as such is not a panacea. Automation of the collection and analysis of primary data is required to make this system work efficiently. However, not all existing versions of software can satisfy the needs of entrepreneurs, because disadvantages often outweigh the benefits. Therefore, we need new ideas to improve real-time managerial accounting, especially for small and medium-sized enterprises, whose subjects do not have sufficient financial resources to purchase standard programs, or are limited in their application due to business specifics [2].

In our opinion, the above points prove the relevance of the study of automation of real-time managerial reporting in agricultural enterprises. Sowing and harvesting continue to be the main activities of agricultural producers; therefore, the authors propose new approaches to the development and application of managerial accounting in these areas of enterprise functioning in crop production.

The purpose of this study is to deepen the methodological and theoretical understanding of the application of managerial accounting in agricultural enterprises through automation of data on sowing and harvesting in crop production. The object of the study is the automation of accounting processes and forms of real-time managerial reporting. The study object is the agricultural enterprises in Omsk region. The subject of the study is theoretical and practical developments in the field of managerial accounting and managerial reporting in agricultural enterprises.

Degree of knowledge. Sufficient attention has been paid to the issues of managerial accounting in domestic theory and practice, which is confirmed by numerous studies by I. Averchev, V.I. Barilenko, M.A. Bakhrushina, N.D. Vrublevsky, A.T. Goloviznina, V.B. Ivashkevich, O.D. Kaverina, T.P. Karpova, V.E. Kerimov, N.P. Kondrakov, I.K. Kondratova, M.V. Melnik, Yu.A. Mishin, I.O. Nikolaeva, O.E. Nikolayeva, V.F. Paly, G.I. Pashigoreva, L.V. Perekrestova, V.S. Plotnikov, O.S. Savchenko, Y.V. Sokolov, V.I. Tkach, V.A. Chernov, A.D. Sheremet, T.V. Shishkova, and others [3].

Managerial accounting issues in agricultural enterprises have been the subject of the study in works by many Russian scientists, including R.A. Alborova, O.A. Blinov, S.V. Bodrikova, C.M. Bychkova, L.N. Vetrova, I.E. Glushkova, A.V. Glushchenko, A.R. Zakirova, T.V. Kisileva, G.S. Klychova, A.P. Kucherin, I.A. Lamykin, G.M. Lisovich, E.S. Mityukova, M.M. Napsheva, N.G. Nebogatikova, N.N. Nelyubova, T.M. Panchenko, L.V. Perekrestova, M.Z. Piesengolz, A.I. Prokofiev, M.V. Stafievskaya, A.B. Tangieva, S.M. Thamokova, I.Yu. Tkachenko, L.I. Khoruzhiy, N.V. Khubiev, O.V. Shestakova, O.V. Shumakova, and others [13, 16, 17].

At the same time, we believe that automation of managerial accounting in agricultural enterprises, has not been studied sufficiently deeply and is reported in pinpoint papers by Russian researchers, including V.N. Boroznets, D.G. Isaeva, O.V. Kaposhko, V.V. Lytneva, L.I. Ryzhov, V.V. Tkachenko, and some others [4].

II. MATERIALS AND METHODS

Despite the fact that financial accounting is similar to managerial accounting, there are obvious differences between them, which include a high level of data specification; the use of special accounts for disclosure; specific methods of accounting and disclosure; short periods between reporting. Automation promotes disclosure in managerial accounting, which makes management decisions more efficient. The automation process is widely used in enterprises [1]. Most agricultural enterprises typically use simple Excel spreadsheets to automate managerial accounting. However, at present more sophisticated ERP systems can be employed. With regard to managerial accounting automation, it should be noted that any automation requires software support, which provides various technical capabilities. The most common in the market for managerial accounting automation include: various systems based on the 1C program (BIT-Finance); Excel spreadsheets; ERP-systems (more often used by large enterprises, for example, 1C: ERP Enterprise Management 2,

1C: CRM, BIT.CRM, StorVerk CRM, Bitrix24.CRM); cloud services [6]. Consider the advantages and disadvantages of the main systems (Table 1).

Automation capabilities are quite large, however, data is still provided 'manually' during sowing and harvesting. Such information includes data, for example, about sowing: how much area is sown, the number of tractor drivers, seed consumption, fertilizer consumption (if applied), fuel consumption, etc. All this information is reported to the management of agricultural enterprises without disclosure, which means that the control system is reduced. We believe that this process needs data automation. This can be done in the 1C system, since agricultural producers in Omsk region most often use it.

TABLE I. ADVANTAGES AND DISADVANTAGES OF MOST POPULAR MANAGERIAL ACCOUNTING AUTOMATION SYSTEMS USED IN AGRICULTURAL ENTERPRISES

Managerial Accounting Program	Advantages	Disadvantages
Reporting based on Excel	<ul style="list-style-type: none"> - availability; - specialized functions to provide simple financial management; - visibility and easy control; - the ability to develop the system using macros. 	<ul style="list-style-type: none"> - over time, tables increase in size and take time to maintain data; - system is limited in integration with other software programs; - managerial accounting problems cannot be solved using only simple formulas, increased complexity of tasks involves programming.
Managerial accounting based on 1C	<ul style="list-style-type: none"> - time reduction for data collection and processing; - timely decision-making based on reliable data of accounting systems; - consideration of various scenarios of enterprise development; - control of payment and spending limits; - prevention of embezzlement or inefficient use of money. 	<ul style="list-style-type: none"> - a software programmer is required for 1C implementation; - low level of data protection; - 1C products are most focused on financial and tax accounting; - additional costs are required to purchase the 1C platform; - frequent updating, which is charged; - only the software programmer can make any additional settings.
Implementation of ERP systems	<ul style="list-style-type: none"> -availability and consistency of data; - control of staff; -decreased number of possible errors; -clear interaction of various system blocks. 	<ul style="list-style-type: none"> - high cost of the software; - requires a solution to data security problems.

We do not consider more complex ERP systems in the current context, since they are more expensive. For example, the implementation of 1C: ERP Enterprise Management 2, which, firstly, is designed for large enterprises, secondly, currently costs 432,000 rubles. However, 1C: ERP Agriculture 2, as an example, costs 499,000 rubles. The installation of additional modules costs about 40,200 rubles to 290,000 rubles, and not every agricultural enterprise can afford it. Additional acquisition of licenses can cost from 120,000

rubles to 5,906,000 rubles, depending on the number of automated workplaces [7].

We believe that systems in the form of Excel spreadsheets and the 1C program, which have many versions, are most feasible financially for agricultural enterprises in Omsk region. The most common are BIT-FINANCE and Standard, which cost from 50,000 rubles to 350,000 rubles [8].

III. DISCUSSION

Reporting on the sowing and harvesting work is no less important for agricultural enterprises than financial accounting reports, since it allows assessment of the real situation and prediction of the pace of work for the future under different weather conditions [9]. Harvesting and sowing are two completely different processes that require different data estimates, therefore, we believe that daily reporting on the results should be compiled in two forms: *Results of harvesting work for the accounting period* and *Results of sowing work for the accounting period*. The accounting period, in this case, is every current day, since data during periods of agricultural work is required daily, due to constantly changing weather conditions, financial capabilities and other factors. Each of the reports should contain the most important indicators for assessing the daily situation (Fig. 1). Each of the indicators should be provided by a person responsible for its formation.

Data should be submitted daily for each team of workers and for each crop and then summarized for the enterprise as a whole. Data essential for the report are submitted by the end of the working day by responsible persons [10]. No doubt, for rapid exchange of data, automation of workplaces and responsible persons themselves is expected. This allows timely submission of data required for the report. Additional expenses for the automation of the workplace may amount to 63,290 rubles including the Internet access, which is necessary for data exchange. The list of the indicators presented by the authors may vary depending on the needs and requirements of the agricultural enterprise. However, the study of the accounting features of agricultural enterprises in Omsk region showed that indicators proposed by the authors are significant and are of great interest for the enterprise management during harvesting [11].

The features of using the forms of real-time managerial reports on sowing and harvesting are as follows:

- Efficiency, which is expressed in data submission on demand, in our case, daily. At the same time, the enterprise management choose what indicators are needed (supplemented or reduced indicators), which increases the efficiency in making not only strategic decisions but also actual ones.
- Real-time managerial reports differ from financial accounting reports in data usefulness, which allows assessment of the actual state of affairs and managerial decisions based on the reports proposed.
- The feature of the proposed reports is their use within the agricultural enterprise only, and accordingly, all indicators, submission procedure and number of

indicators are not regulated by law and may vary depending on the tasks to be fulfilled by the enterprise.

- Detailing allows considering data both with regard to teams of workers and to crops, which helps make decisions not only on redistribution of expenses by responsibility centers but also by types of products, as well as make decisions regarding certain employees and structural units.
- Forecasting horizon. The use of the proposed forms is an important tool for predicting the timing and work intensity, since agriculture, in particular crop production, is an industry that largely depends on weather conditions, and the assessment of data submitted allows the enterprise management to make decisions quickly [12].

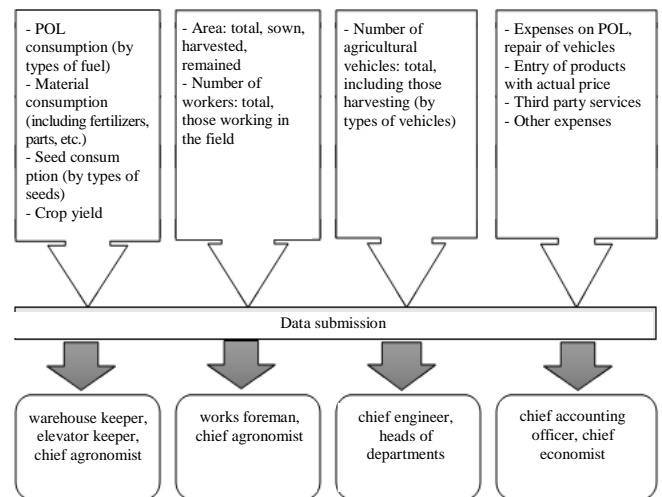


Fig. 1. Data for preparing the reports on sowing and harvesting works and persons responsible for their compilation

IV. RESULTS

The report can be formed both by the types of crops, that is, by the types of the finished products of crop production, and by the teams of workers, that is, by the centers of responsibility. Any time period can be taken as a period, in particular, in our opinion, the most popular may be a day, a week, and a month. The report is supposed to be grouped based on growing results in order to see the amount of work done and establish the desired work intensity, which can be affected by numerous factors, among the most common factors are weather conditions (Tables 2, 3).

The set of indicators presented can be selected independently in the 1C system, depending on the type of work performed. Thus, when sowing, the most important indicators are planted acreages, and consumption of seeds and fertilizer (Table 2). However, when harvesting, crop yield and productivity, which will be determined after harvesting, are considered to be important indicators (Table 3). Both reports will include similar indicators, in particular, the number of agricultural vehicles, the number of workers, POL consumption, etc., that is, those indicators that are achieved

daily regardless of the type of work. The user will be given the opportunity to independently choose one or another set of indicators depending on the tasks and the type of work. We believe that the plan to be fulfilled will also be a relevant indicator, since it serves as a guide to determine the intensity of future work.

TABLE II. REPORT FORM RESULTS OF SOWING WORK FOR THE ACCOUNTING PERIOD

Indicators	Actual performance							Plan (based on results of the previous year)
	Month _____							
	Days						Total	
1	2	3	4	5	...			
1. Total area, ha	*	*	*	*	*	*	*	**
including sown area	*	*	*	*	*	*	*	**
2. Total number of agricultural vehicles, pcs.	*	*	*	*	*	*	*	**
... (by types of vehicles)	*	*	*	*	*	*	*	**
including those not working at the moment	*	*	*	*	*	*	*	**
... (by types of vehicles)	*	*	*	*	*	*	*	**
3. Total seed consumption, c	*	*	*	*	*	*	*	**
... (by types of seed)	*	*	*	*	*	*	*	**
4. Total number of workers, ind.	*	*	*	*	*	*	*	**
... (with regard to teams of workers and to class of workers)	*	*	*	*	*	*	*	**
5. Total POL consumption, l	*	*	*	*	*	*	*	**
... (with regard to teams of workers and to type of fuel)	*	*	*	*	*	*	*	**
6. Total amount of fertilizers, c	*	*	*	*	*	*	*	**
... (with regard to teams of workers and to types)	*	*	*	*	*	*	*	**
7. Other types of work	*	*	*	*	*	*	*	**
... (by types of work)	*	*	*	*	*	*	*	**

* – data for the report are submitted daily by responsible persons (Fig. 1)
** – data for the report are submitted by the main specialists

^a Compiled by the authors

The developed forms of real-time managerial reports on sowing and harvesting can be generated in the 1C: Accounting 8.3 program. For this purpose, we propose to create an additional *Real-time report* tab in *Reports* tab. *Real-time report* tab will include all managerial real time reports that are necessary for the chief, namely: reports *Results of sowing* and *Results of harvesting*. The forms of real time managerial reports that need to be created in the program are presented in Tables 2, 3.

To prepare real-time managerial reports, an accountant (economist) must first create a nomenclature for the types of seeds and finished products, fuel, fertilizers, etc. [14]. To do this, it is necessary to fill in the directory *Nomenclature* in *Directories* tab.

TABLE III. REPORT FORM RESULTS OF HARVESTING WORK FOR THE ACCOUNTING PERIOD

Indicators	Actual performance							Plan (based on results of the previous year)
	Month _____							
	Days						Total	
1	2	3	4	5	...			
1. Total area, ha	*	*	*	*	*	*	*	**
including harvested area	*	*	*	*	*	*	*	**
2. Total number of agricultural vehicles, pcs	*	*	*	*	*	*	*	**
... (by types of vehicles)	*	*	*	*	*	*	*	**
including those not working	*	*	*	*	*	*	*	**
... (by types of vehicles)	*	*	*	*	*	*	*	**
3. Total crop yield, c	*	*	*	*	*	*	*	**
... (by types of crops, finished products)	*	*	*	*	*	*	*	**
4. Total number of workers, ind.	*	*	*	*	*	*	*	**
... (by teams of workers and by class of workers)	*	*	*	*	*	*	*	**
5. Total POL consumption, l	*	*	*	*	*	*	*	**
... (with regard to teams of workers and to type of fuel)	*	*	*	*	*	*	*	**
... (with regard to teams of workers and to types)	*	*	*	*	*	*	*	**
6. Other types of work	*	*	*	*	*	*	*	**
... (by types of work)	*	*	*	*	*	*	*	**

* – data for the report are submitted daily by responsible persons (Fig. 1)
** – data for the report are submitted by the main specialists

^b Compiled by the authors

V. CONCLUSION

Managerial accounting is largely an additional provider of data required for decision-making [15], which capabilities are great and its use by agricultural enterprises in the form of additional forms of managerial reports, in particular, on harvesting and sowing, has certain advantages, namely:

- Real-time control of harvesting and sowing work in crop production, which makes assessment of the situation more effective, provides data on the actual state of affairs, expenses, and work intensity, and allows a short-term forecast.
- Identification of positive and negative aspects in agricultural work to timely adjust certain indicators and optimize processes.
- The financial accounting reports cannot provide full information during the period of agricultural work. The proposed report forms show the daily work progress by teams and by crops; these data accumulate at the end of the week, after some days, which enables control of the work intensity.

The proposed forms are available, but they are submitted to the enterprise management in the form of notes that are voiced in morning planning meetings. These forms show the actual state of affairs in all agricultural enterprises, and the automation of the reports preparation would make the process efficient and effective. Similar to any innovation, it requires investments from enterprises, which, however, will be compensated by timely presented information.

Thus, the automation of managerial accounting in the field of crop production will allow actual control of the situation, full-scale development of the enterprise, timely prevention of possible problems and, accordingly, achievement of excellent results in the work and successful solution of the arising problems.

References

- [1] E.V. Botchenko, "Cost accounting for crop production: features, problems, prospects", vol. 13, pp. 105–108, 2016 [Proc. of the Conf. of Young Sci. of Altai State Univer.].
- [2] L.N. Goncharenko, E.N. Eremina, "Features of cost accounting and costing of services at elevator complexes", *Electr. Sci. and Methodol. J. of Omsk State Agrar. Univer.*, vol. 4, no. 19, p. 5, 2019.
- [3] O.S. Deyvald, V.Yu. Epanchintsev, "General principles for calculating the cost of production, work, services", *Electr. Sci. and Methodol. J. of Omsk State Agrar. Univer.*, vol. 4, no. 11, p. 17, 2017.
- [4] I.A. Korostelkina, E.G. Dedkova, "Effect of industry-specific features on formulation of a management accounting system at enterprises in the crop production sector", *Managerial Account.*, vol. 4, pp. 18–25, 2018.
- [5] *National projects: key objectives and expected results*. Moscow, 2019. Retrieved from: <http://government.ru/news/35675/> (March 11, 2020).
- [6] Yu.I. Novikov, D.R. Bayetova, "Grain export as a factor in the sustainable development of rural territories of Omsk Region", *Food Engineer. and Technol.*, vol. 48, no. 3, pp. 50–57, 2018.
- [7] L.I. Ryzhova, "Conceptual approaches to the automation of managerial accounting and trends in its development in agricultural enterprises", *Econ. Sci.*, vol. 130, pp. 115–117, 2015.
- [8] M.V. Stafievskaya, "Improving cost accounting in crop production", *Busin. Ed. Right*, vol. 4, no. 49, pp. 189–196, 2019.
- [9] A.B. Tangiev, "Problems of managerial accounting in agricultural enterprises", *Advan. in Sci. and Ed.*, vol. 11, no. 33, pp. 30–31, 2018.
- [10] V.V. Tkachenko, V.V. Lytnev, "Development of a comprehensive automated information system for decision support in the management of technological processes of crop production (based on materials of the agro-industrial complex of Krasnodar Territory)", *Bull. of Acad. of Knowledge*, vol. 6, no. 29, pp. 249–253, 2018.
- [11] S.M. Tkhamokova, "Features of managerial cost accounting in crop production", *Bull. of Siber. Instit. of Busin. and Inform. Technol.*, vol. 1, no. 25, pp. 67–72, 2017.
- [12] M.Kh. Shogenova, "Organizational support of managerial accounting in crop production", *Advan. in Modern Sci. and Ed.*, vol. 1, no. 10, pp. 120–122, 2016.
- [13] O.V. Shumakova, O.A. Blinov, "Managerial Accounting in Agricultural Organizations", pp. 90–905, 2017 [Proc. of the 2nd All-Russ. (National) Sci. Conf. of Novosibirsk State Agrarian University. Novosibirsk: IC Zolotoy Kolos].
- [14] O.V. Shumakova, O.A. Blinov, D.R. Baetova, "Assessing the economic status of agricultural organizations in Omsk region in the context of budgeting", *Moscow Econ. J.*, vol. 13, p. 24, 2019.
- [15] O. Zaitseva, D. Baetova, E. Golova, O. Kozlova, "Standard of Living and Quality of Life of Rural Population in Omsk Region Advances in Social Science, Education and Humanities Research", *The Fifth Technological Order: Prospects for the Development and Modernization of the Russian Agro-Industrial Sector*, Ch. 393, pp. 161–166, 2019.
- [16] O.V. Shumakova, O.A. Blinov, S.L. Khrabrykh, T.G. Mozzherina, O.N. Kryukova, "Disclosure of Assets of Agricultural Enterprises in the Financial Reporting under International Financial Reporting Standards", *Int. J. of Econ. and Financial Issues*, vol. 6, 2016.
- [17] O.V. Shumakova, E.V. Kovalenko, M.N. Gapon, "Developing a methodological approach to cost managerial accounting", *Actual Econ. Issues*, vol. 9, no. 159, pp. 447–455, 2014.