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VALUATION OF PLANT BIOLOGICAL ASSETS TAKING INTO ACCOUNT THE RISK OF CONDUCTING AGRICULTURAL ACTIVITY

Summary

Introduction

Economic entities which conduct agricultural activity subject to the provisions of the Accounting Act have a problem with the valuation of plantations of crops at the stage of production in progress. They frequently give up the valuation of this part of property which affects the reliability and quality of their financial statements. Therefore, it is necessary to develop a method of valuation of plant biological assets that would allow for the valuation of agricultural production in progress, taking into account the risk of conducting agricultural activity. The literature on the subject does not contain valuation methods allowing for a reliable and credible determination of the value of plant production in progress, e.g. rape or wheat plantations. Developing a method of valuation of plant biological assets, which takes into account the risk of conducting agricultural activity, will allow the implementation of one of the overriding accounting principles, i.e. the principle of a reliable and accurate image of the financial standing and the financial performance of an agricultural enterprise. The use of the method of valuation of plant biological assets taking into account the risk will also increase the quality of financial statements by presenting values that are useful and reliable.

Research problem, aims and objectives

The premises for writing this monograph are the problems associated with the valuation of plant biological assets at the stage of production in progress and the specificity of agricultural activity, which is reflected in the risk borne by economic entities conducting such activity. Following the issues in question, a research problem has been identified within the area of accounting and financial reporting, as well as agriculture; the problem boils down to the examination of:

- the methods of valuation of plant biological assets at the stage of production in progress,
- the impact of the valuation methods applied on the values presented in financial statements.

The main aim of this work is to develop a method of valuation of plant biological assets reflecting the process of biological transformation, taking into account the impact of risk on conducting agricultural activity (on the example of rape). In order to achieve the main aim, the author has had to define and realise the following specific objectives:

- a) analysing and developing the author's own definition of an agricultural holding, agricultural activity, agricultural accounting and plant biological assets,
- b) identifying the specificity of agricultural activity and assessing its impact on the valuation in accounting,
- c) reviewing concepts and theories relating to financial valuation and reporting,
- d) comparing two opposing bases of valuation: historical cost and fair value,
- e) comparing the principles of valuation of plant biological assets contained in Polish and international accounting regulations,
- f) analysing the existing solutions concerning the registration of the process of valuation of plant biological assets at the stage of production in progress,
- g) identifying the risk areas and risk measurement in agricultural activity,
- h) analysing the process of rape production,
- i) studying the influence of climatic conditions on the productivity and price of rape,
- j) carrying out a valuation of plant biological assets on the example of rape using various methods of valuation at historical cost and at fair value,
- k) assessing the impact of the applied methods of valuation of plant biological assets on the quality of financial statements and on the values presented in the statements.

The research entity of the monograph is an economic unit (within the meaning of the Accounting Act) conducting agricultural activity, whereas the research subject is the valuation of rape as an example of a plant biological asset. The time range of the research encompasses the years 2005–2014.

The nature of this study is normative and project-like, boiling down to presenting the author's proposal for a practical solution to the problem of valuation of biological plant assets at the stage of production in progress, taking into account the risk of agricultural activity. The monograph draws on Polish and English-language literature, provisions of Polish and international law on ac-

counting and agriculture (as of March 31, 2021), as well as information available on the Internet. The research is based on data from the Wielkopolska Agricultural Advisory Center in Poznań (WODR), Wielkopolska Chamber of Agriculture (WIR), Statistics Poland (GUS), Farm Accountancy Data Network (FADN) and the Institute of Meteorology and Water Management (IMGW).

The proposed valuation method may be applicable and support financial and accounting services in the process of preparing financial statements as well as making management decisions. The study fills a research gap existing in this area, particularly in the Polish literature on the subject.

Methodology

The implementation of both the main aim and the specific objectives has determined the choice of research methods. The following qualitative methods have been used in the study: the descriptive method, the method of critical analysis of literature, the method of logical inference, the method of comparative analysis and the method of deduction. In order to conduct empirical research, the following quantitative methods have been used: statistical methods, the simulation method, the method of evaluation of investment effectiveness and the real options method. The empirical research has been divided into the following stages:

1. Measurement of meteorological risk in agricultural activities.
2. Analysis of the production process of rape.
3. Analysis of data on meteorological and climatological conditions in the Wielkopolska Macroregion in 2005–2014 (data sources: GUS, IMWM, WODR, WIR).
4. Analysis of data on rape fertility in 2005–2014 (data sources: GUS, FADN, farms, WODR, WIR).
5. Analysis of rape prices in 2005–2014 (data sources: MATIF exchange in Paris, CBOT exchange in Chicago, farms, GUS, commodity exchanges in Poland, WODR, WIR).
6. Analysis of the influence of climatic conditions on the productivity and price of rape.
7. Rape valuation at historical cost.
8. Rape valuation at fair value.
9. Development of a hybrid valuation method.
10. Rape valuation using the real options method.
11. Assessment of the impact of applying the methods of the balance sheet valuation of rape on the quality of information and values presented in financial statements.

The author's considerations contributed to the confirmation of the legitimacy of formulating the main research aim, i.e. developing a method of valuation of plant biological assets reflecting the biological transformation process, taking into account the impact of risk on conducting agricultural activity (on the example of rape).

Findings

The conducted literature studies allow to conclude that economic entities conducting agricultural activity frequently give up the valuation of plant biological assets at the stage of production in progress. The main reason for this is that the provisions of the Accounting Act allow the possibility of resigning from the valuation of agricultural production in progress. Furthermore, research conducted by Elwira Laskowska among property appraisers in the field of valuation of agricultural production proved that, in the opinion of the respondents, the reason for resigning from the valuation is very limited availability of literature on the valuation of agricultural production in progress. The lack of available literature implies problems with the valuation and prompts agricultural entities to exercise the right to waive the valuation. According to many accounting theorists and practitioners, the resignation from the valuation of plant production in progress results in incorrect presentation of the image of the financial standing of entities running agricultural activity.

The results of the conducted literature and empirical research are numerous conclusions regarding the valuation of plant biological assets at the stage of production in progress, in particular the advantages and disadvantages of valuation at historical cost and fair value.

An analysis of the literature in terms of the definition of agricultural accounting has allowed the author to propose an original definition of agricultural accounting, understood as a system for collecting, processing and presenting data on the property, financial situation and financial performance of an agricultural enterprise, taking into account the specificity of conducting agricultural activity.

The term 'plant biological assets' was first introduced into accounting in International Accounting Standard 41 (IAS 41) "Agriculture". On the basis of the definition contained therein and the definitions cited by the literature on the subject, the author has formulated an original definition of plant biological assets, defining them as a set of plants with similar characteristics, constantly undergoing the process of biological transformation from the moment of preparing the field for sowing to the point of collection or harvest.

A comparative analysis of historical cost and fair value made it possible to identify the advantages and disadvantages of these bases of valuation. The

main advantages of the historical cost valuation are simplicity, comprehensibility and basing the measurement on source data, which increases the credibility of the valuation. The main drawback of the valuation at historical cost is the failure to take into account changes in value over time and the failure to reflect future economic benefits. In turn, the greatest advantage of the valuation at fair value is the reflection of changes in value over time and future economic benefits. In addition, fair value responds to the increasing demand for calculations of cash flows that an entity can receive. The opponents of fair value question the reliability of the results obtained from the application of this type of valuation, substantiating this argument by the fact that fair value is based on estimates. In their opinion, the lack of credibility of the valuation of the enterprise's assets and liabilities reduces the usefulness of the information contained in its financial statements. In extreme cases, the financial statements may be considered unreliable and, consequently, useless.

It has been proven that the valuation of balance sheet components has been and will be the most complicated task of the accounting system, both in theoretical and practical terms. Both the historical cost and fair value as the bases of valuation are not free from defects. However, in recent years, neither accounting theory nor practice has developed an alternative concept of valuation. The author concludes that there is no need to demonstrate the superiority of one of these valuation concepts over the other. Such aspects as the complexity of the purposes for which the valuation is made, the specific nature of the business and the variety of valued balance sheet items mean that in most cases different bases and valuation parameters should be used, which translates into the uniqueness of the applied valuation principles for specific balance sheet items.

According to the author, accounting is moving towards a mixed valuation model. Historical cost is more appropriate for some assets, and fair value for other assets. Sometimes it is necessary to use more than one basis for the valuation process, and only this enables the provision of useful and reliable information about the condition of economic entities. Fair value and the historical cost methods as well as other cash flow methods together make up a response to the objectives set by users of financial statements.

The research carried out by the author proved that the valuation of plant biological assets at the stage of production in progress using the historical cost (according to the Accounting Act) is based on the activation of costs. Plant production in progress, valued at historical cost, does not affect the agricultural enterprise's financial result for a period. In this case, the costs related to plant production in progress affect the financial result only when the plant biological asset is sold or when the final product is sold (after collection / harvest it is no longer a plant biological asset but a finished product).

On the other hand, IAS 41 "Agriculture" requires that the financial result for a period should include the profit or loss arising on the initial recognition of biological assets as well as arising from the change in fair value of the balance sheet. According to the author, this is an overly bold approach to the issue of recognising the effects of the valuation of plant production in progress in the financial result for a period. The author is of the opinion that it would be more appropriate to take into account the effects of the valuation both on initial recognition in the accounting records and for subsequent balance sheet days, with the transfer of the valuation effects to equity (revaluation reserve). Only when a plant biological asset is sold at the stage of production in progress or when the plant biological asset transforms into a finished product and is sold, the amounts recognised in equity should be transferred to the entity's financial result. Negative and positive differences arising from the measurement at fair value, representing unrealised revenues and costs, should be recognised in the revaluation capital (overvaluation), which is a component of the entity's equity. Recognition of unrealised revenues and costs in the entity's financial result leads to failure to respect the concept of the principle of a reliable and accurate image of the financial standing of an entity, as well as the principle of prudent valuation. Unrealised revenues may create a positive financial result that is not reflected in the entity's economic benefits during the period. Only during the execution of a sale transaction are the economic benefits achieved, supported by cash flows.

According to IAS 41, by recognising the effects of a fair value measurement in the financial result for a period, the effects of changes in the value of a plant biological asset due to biological transformation will be reflected in the profit and loss account. This only applies to biological assets at the stage of production in progress, i.e. until collection / harvest. However, what should be highlighted here is the fact that plant biological assets are also influenced by climatic factors, which may cause even a complete loss in value of plant production in progress. Unrealised revenues and costs previously recognised in the financial result for a period become groundless and even falsify the statement in the event of destruction of plantations of biological assets. In addition, it should be noted that the value of plant biological assets is influenced, on the one hand, by changes in physical characteristics resulting from the process of growth, development, maturation and aging of the plant, and on the other hand, by their physical degradation resulting from adverse weather events (floods, droughts, storms, etc.). The fair value reflects, among other things, the risk of farming activities and the related uncertainty. Therefore, it cannot affect the financial result for a period, until it is a value that reflects an executed transaction and a value calculated on the basis of data from the market. In the author's opinion, until the biological transformation process is completed, changes in the fair value of a plant biological asset should not be recognised in the financial result for a period.

The following main areas of risk of conducting agricultural activity have been identified:

- atmospheric conditions,
- climatic conditions,
- soil conditions.

In the context of atmospheric conditions and climatic conditions, the measurement of the meteorological risk in agricultural activities has been carried out, using the following parameters on a monthly basis: average temperature, total rainfall and sunshine duration. Empirical studies have confirmed the presence of the high level of meteorological risk, particularly in the winter-spring months, which are of key importance for the development of a plant biological asset. In the winter months, the greatest risk was related to the variability of the average air temperature, and in the spring months, it resulted from excess or shortage of rainfall. The lowest meteorological risk was found in the case of sunshine duration, the variability of which, especially in the spring and summer months, was quite low, which implies a low risk of agricultural activity due to the plant's access to light in the studied period.

A comparative analysis of the structure of land valuation classes in Poland by voivodeships has led the author to conclude that the risk related to soil conditions due to a relatively small amplitude of soil quality in Poland does not have to be specially considered in the methods of valuation of plant production in progress. This risk, however, should be indirectly reflected in the broadly understood risk of running agricultural activity.

The analysis of the rape production process has made it possible to identify the key moment in the production cycle of rape, which is the turn of winter and spring. It is at this point that the risk of complete destruction of the plantation due to bad wintering ceases to affect the value of plant production in progress.

Empirical studies have proven that it is not possible to create a linear regression model (a single-equation model with explanatory variables) that would make the value of rape productivity dependent on the climatic conditions measured by such meteorological parameters as the average air temperature, rainfall total or sunshine duration. The inability to construct such a model precludes its application to the valuation of plant biological assets at the stage of production in progress.

The simulation of rape valuation using the methods of historical cost valuation has confirmed that these methods do not reflect the risk of conducting agricultural activity. Historical cost valuation underestimates the value of production in progress, especially in the second part of the production cycle, i.e. from the beginning of spring to the point of harvest. The historical cost also does not reflect the biological growth potential of a plant resulting from conducting the

process of photosynthesis. Additionally, the author agrees with the thesis of Josep M. Argilés and John Slof that valuation according to historical cost generates much higher costs than valuation at fair value.

The value obtained by using the income method based on fair value includes the intangible assets of plant production in progress. Furthermore, it reflects the risk of agricultural activity better than the historical cost method. In this method, the risk is reflected by including intangible assets and using a discount rate in the calculation formula. This method has the greatest cognitive value in the second part of the production cycle of rape, i.e. in the period from spring to the point of harvest of the biological asset. The closer it is to the harvest time, the closer the values are to the market value of rape seeds. The fair value also reflects the effects of the biological transformation process. Nevertheless, in the first period of the rape production cycle, i.e. in the autumn-winter period, the values obtained as a result of the income method (at fair value) are considered unreliable, because at such an early stage of plant development it is difficult to forecast future economic benefits. A more adequate method of valuation in this period is the method of direct production costs (the method of valuation according to the historical cost). This method does not overstate the value of the plant biological asset in the autumn and winter period.

It should be noted that the fair value calculated using the income method is not an ideal measure and does not comprehensively reflect the specificity of agricultural activity. Certainly, this value does not take into account the risk resulting from the influence of atmospheric factors. Violent weather phenomena (storms, floods) can significantly destroy a plantation in a fraction of a second, which in turn will significantly reduce the value of agricultural production in progress. In extreme cases, a given crop may even be completely destroyed.

Practical implications

The proposed hybrid valuation method has been developed on the basis of the method of direct production costs and the income method, as well as on the basis of the analysis of the production process of rape, therefore it has been adapted to the needs of valuation in two different periods of the production cycle of rape. The research carried out by the author confirms the usefulness and credibility of the hybrid valuation method. This method reflects to a greater extent the intangible values of the plant biological asset in the period from March to July compared to the methods based on historical cost. In addition, it does not overestimate the value of the plant biological asset in the autumn and winter period, as is the case in the income method. This method combines the advantages of both the valuation methods based on historical cost and fair value.

The hybrid method of valuation can be successfully applied to the valuation of not only rape, but also winter cereals and other crops that are sown in the autumn of one year, and harvested in the summer of the following year. This method is characterised by the highest cognitive value for plants that are forced to overwinter in the field.

The valuation carried out using the real options method allowed for the recognition of the risk of fluctuations in rape prices on the world markets. However, it has not fully reflected the meteorological risk. As a result of the valuation using the real options method, an additional value was created in the form of flexibility related to decision-making. This value reflects the risk borne by the investor during the implementation of the investment project.

Valuation with the use of real options in the context of Polish and international accounting law has one major drawback. As the time horizon of the analysis is extended, the value of the options increases, together with the risk of overvaluation. The high risk of overestimating the valuation limits the possibility of a reliable estimation of the value of agricultural production in progress for the purpose of the balance sheet valuation. Valuation using real options cannot be used for measuring balance sheet assets. It can only be a guideline for the management of the unit to decide on the termination of the rape plantation.

Originality and value

The conducted research will contribute to an increase in the reliability of information generated by enterprises which conduct agricultural activity, subject to the Accounting Act. The developed hybrid method of valuation of plant biological assets will increase the credibility and quality of financial statements made by these enterprises.

The main cognitive values of this work include the following:

- drawing attention to the problem of valuation of plant production in progress,
- proposing original definitions of the concepts of an agricultural holding, agricultural activity, agricultural accounting, plant biological assets and plant production in progress,
- developing a hybrid valuation method that combines the advantages of valuation at historical cost and at fair value,
- a proposal to recognise the effects of the valuation of plant production in progress at fair value in the revaluation reserve,
- considerations regarding the suitability of the historical cost and fair value methods for valuating plant biological assets at the stage of production in progress,

- research on the applicability of the linear regression model (single-equation model with explanatory variables) to the valuation of plant biological assets at the stage of production in progress,
- assessment of the possibility of the valuation of the plant biological asset at the stage of production in progress using the real options method,
- comprehensive analysis of legal acts regarding the valuation of plant biological assets and the presentation of the results of their valuation in financial statements.

The author hopes that the presented considerations may serve as a contribution to further research on:

- the methods of valuation of plant biological assets at the stage of production in progress,
- using the real options method for the valuation of production in progress,
- using a hybrid valuation method for the valuation of plant biological assets other than rape,
- the process for recognising changes in fair value in financial statements,
- using hedge accounting instruments to reduce the risk of conducting agricultural activity.

The monograph will broaden the discussion held in the scientific community on the adaptation of the accounting system to the specificity of agricultural activity and will draw attention to the most important problem of agricultural accounting, which is the valuation of plant biological assets at the stage of production in progress.

Translated by Krzysztof Stec

See more in the monograph in Polish:
 D. Obrzeźgiewicz. (2022). *Wycena roślinnych aktywów biologicznych z uwzględnieniem ryzyka prowadzenia działalności rolnej*. Poznań: Wydawnictwo Uniwersytetu Ekonomicznego w Poznaniu. <https://doi.org/10.18559/978-83-8211-118-7>