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# COST BASED BUDGETING AND FI-NANCIAL PLANNING MODEL FOR CROP FARMS

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## VAASAN AMMATTIKORKEAKOULU International business

# TIIVISTELMÄ

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Maatalouden taloudellinen toimintaympäristö on muovautunut huomattavasti viimeisimpien vuosikymmenten aikana. Maatilojen yksikkökoko on kasvanut samalla lisäten alan pääomavaltaisuutta sekä rahavirtojen suuruutta. Tällä kehityksellä on ollut vaikutus maatalouden talousjohtamisen tarpeisiin jonka tulisi vastata toimintaympäristön muutokseen ja heikentyneeseen kannattavuuteen.

Lopputyö kuvaa taloudellisen suunnittelutyökalun mallin, jota voidaan hyödyntää kasvitilan kannattavuuslaskennassa sekä muussa taloussuunnittelussa maatilan kannattavan liiketoiminnan edistämiseksi. Malli tuottaa kasvitilalle sopivaksi muokatun budjetoidun tuloslaskelman neljälle tulevalle varainhoitovuodelle, jonka perustaksi maatilan arvioidut tulot ja menot on koottu aiemassa vaiheessa kategorisoidusti ja ohjatusti.

Malli pyrkii huomioimaan ja esittämään maatilayritysten erityiset kulu- ja tuloerät lisäten sen tarkoituksenmukaisuutta kasvitilalla tapahtuvaan taloussuunnitteluun. Teoriat ja menetelmät ovat johdettu yleisistä liikkeenjohdollisista aineisoista käsittäen perustavalaatuisia budjetointimenetelmiä, joita voidaan soveltaen hyödyntää toimialakohtaisesti.

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# ABSTRACT

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The financial operating environment of agribusinesses has changed during the last decades. Farm unit sizes have increased simultaneously increasing capital intensity and financial volumes on farms. This development has impacted the needs and requirements of financial management on farms, which needs to respond to the evolving operational environment and diminished profitability.

In this thesis a financial planning model was developed to be used as a tool for assessing profitability and other financial information needs on crop farms to improve the financial performance of farms. The developed model provides a forecasted budgeted income statement adjusted for the crop farming business for four consecutive financial periods based on structurally established, categorized, and allocated income and costs from a farm's business operations.

The developed model aims to consider specific sources of income and cost on crop farming business adding to its meaningfulness as an industry specific financial planning tool. Theories and practices used when establishing the model derive from commonly acknowledged theories in scientific financial management describing fundamental business management practices that can be applied in applications for specific sectors.

Keywords

Profitability assessment, financial planning, budgeting, financial management

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## **1** INTRODUCTION

Agriculture is considered to be the innovation which allowed development of civilizations. In contrast to gathering food, it was possible to produce a surplus of food that enabled establishing permanent habitation with larger populations leading to advanced cultures. Even though agriculture and farming were taken into use approximately 11,500 years ago, most drastic development within agriculture in general has occurred during the past hundred years. The most radical changes within agricultural changes in the Western world have occurred during the latest 25 years shaping the industry in significant extent. (National Geographic Society 2019)

Notable development started during the industrialization era in the 18<sup>th</sup>-century when mechanization and new mobile technologies allowed utilizing larger areas in farming simultaneously ensuring higher productivity with improved machinery. Selective breeding made possible to develop more productive livestock animals and production crops alongside with more advanced fertilization and other agricultural methods further increasing harvests. (National Geographic Society 2019)

Farming and agricultural industry have not developed from agricultural standpoint only. The evolved industry has experienced changes in financial respect through reformed operating environment of businesses involved in primary production of food. Recent changes in the financial environment have formed the industry through forcing active farmers to increase amount of cultivated land and unit size of farms leading to larger financial volumes on farms engaged in production of food crops. (National Geographic Society 2019)

Due to the reformation of business environment in the farms, farmers are forced to improve their business management mechanisms and capabilities, including enhancing management of their financial resources as part of their operating models. It has been established that planning including financial perspective of operations is important for sustainable development of enterprises and serve as an important mean to control usage of available resources that can be financial capital, time, physical facilities, machinery, and labor force (Poapst 1965). Increasing competition, industrialization, internationalization, and costs are current issues for farmers requiring attention of farmers globally. As a result of lowered barriers for transfer of goods, in addition to regional competition between farms, international competition gains ground especially in areas where the level of financial integration is high, like within the region of the European Union and its trading partners. To ensure long-term financial sustainability of their businesses farmers need to acquire tools to improve their financial performance in addition to cultivation methods. (North Dakota State University 2020)

Planning should be executed to guide decision-making in the enterprises to ensure better utilization of the available resources ensuring higher level of profitability. Better utilization of resources allows increased competitiveness for businesses producing higher wages for personnel and stakeholders, lower prices for consumers and increased benefit for the surrounding society from business operations. (Poapst 1965)

In this thesis financial budgeting and planning are studied and the acquired knowledge is applied into practice by creating a model for a financial profitability assessment for crop farming operations. The created model is explained in this thesis and its structure is presented both in writing and visualized in simplified means using a spreadsheet model. The objective of developing the model is to assist Finnish crop farms' management to examine the usage of their financial resources and to enhance their profitability in pursuit of increasing international competitiveness of Finnish farm operations.

This thesis is divided into five chapters, first being the introduction to the subject. In the second chapter the objective of this thesis is further explained, and the current operating environment of Finnish farms with associated managerial needs is studied. In the third chapter theoretical framework for financial planning and framework for a profitability assessment is discussed. Based on the theoretical framework in the fourth chapter a model and method for profitability assessment of a crop farm is created and explained in closer detail. In the fifth chapter the studied subject is summarized, as well the utility of the created model together with areas of improvement and further development regarding the topic are discussed.

## 2 PURPOSE OF THE THESIS AND BACKGROUND

#### 2.1 Objective of the thesis

The objective of this thesis is to create a model for profitability assessment to be used on farms involved in crop production. The aim is to increase consciousness of the current financial capacity and financial effectiveness on farm operations by providing a tool which can be used for financial planning and management operations on farms. Profitability assessment could be also used to assist in allocating available financial resources, plan investments, and detect needs for external financing.

The objective of this thesis is to improve Finnish farmers' decision-making process concerning farm finances resulting in better financial performance and improved profitability alongside increased international competitiveness. In this thesis better financial management tools are seen as an important aspect of business operations in producing long-term economic sustainability for the Finnish agricultural primary sector.

Planning and forecasting business operations in financial and productional terms has been extensively studied since the beginning of the era of industrialization. Important findings have been conducted resulting, for instance, to improved usage of available resources in many industries. Greater improvements have been achieved within manufacturing industries and primary production than in the service industry as a result of higher predictability of operational variables. However, complexity in the operations and the operating environment has been constantly increasing in all industries throughout the modern era deriving from the advancement of modern technologies and production chains. (Harvard Business Review 1995)

Even though forecasting and evaluating financial outcomes of managerial actions cannot be the explicit purpose of management – appropriately used budgets and other business assessment methods increase the potential of any business to succeed on the long term and create sustainable business opportunities in addition to growth.

Planning and efficient budgeting of available resources is important to any organization from tertiary industry to primary production. Therefore, the importance of financial management applies to the agricultural industry in which farm businesses operates. (Harvard Business Review 1995)

Optimal allocation of resources is often the main target of production economics, which itself is a desirable target. However, optimal allocation of resources requires close-to perfect information that is not available on most – if any – industries making pursuit of optimal allocation of resources a less meaningful target (Nuthall 2009, 15).

Farming and agriculture related businesses depend on human decisions in management level where decisions are made in an environment where many factors are beyond human control. Unpredictable factors affecting the financial performance of farms among others are weather conditions, spreading of plant deceases, external threats affecting demand, and therefore farm businesses are exposed to uncertainty. Correspondingly, food production on primary level is exposed on multiple variables, which need to be considered when executing assessment and forecasting of farm businesses' financial capabilities and resources.

The focus on this thesis is establishing a concept for a profitability assessment model suiting the needs of crop farming. Hence, the application of theories into the profitability model is explained on concept level describing the model's accounting logic with the necessary visual aids. Detail in the description on the abovementioned logic aims to provide enough information for a software developer to program a computer program following the flow of events and transactions which are taken to prepare a farm's profitability assessment. Desired operating mechanics of the software can be described into a necessary extent in case it can provide a clearer depiction for the reader.

The profitability assessment model is limited to producing a calculation of profitability for farm business. Therefore, investment evaluation methods, balance sheet management, tax planning, or cash flow management issues are not addressed. The prepared model is originally designed based on typical requirements on Finnish farms and presented on a general level measuring profitability. However, the model can be modified to correspond to the profitability assessment needs of farm businesses' use in other countries, as well.

#### 2.2 Recent development within agriculture in Finland

As the industrialization within the agriculture sector has progressed changes in the operational environment have actively transformed the requirements set for businesses involved in the primary food production. Enhanced productivity of farm equipment and machinery have resulted in decreasing the number of farms and increased unit size, volume in inbound- and outbound money flows, higher cost of capital in form of expanded balance sheet, new investment requirements, among others. Therefore, modern farmers manage bigger properties also in financial terms increasing difficulty in managerial tasks including management of larger financial volumes from business operations. (Niemi & Väre 2018)



**Figure 1.** During last two decades the number of persons employed by agriculture and horticulture has plummeted. (Natural Resources Institute Finland 2018a)

Far-reaching changes within the agricultural primary production sector in Finland have been a strong decrease in persons employed in agriculture and rapid decline in number of active farms. During the early 20<sup>th</sup>-century around half of the Finnish labour force was employed within agriculture. In the 2016 number of people employed by agriculture and horticulture had diminished to 99,000, which represents 3.6% of the total Finnish labour force of 2,707 million people (Statistics Finland 2019).

The decline in people employed by agriculture has been in connection to a strong decline in the number of active farms in Finland, as well. In the 1990s over 50,000 farms were discontinued, and number of active farms in 2018 remained only as 47,333. Currently, the annual decrease in number of farms in Finland is 3% and same development is estimated to remain in near future (Natural Resources Institution Finland 2018). Of these, around 33,000 or 70% are having plant production as the primary production line. (Natural Resources Institute Finland 2019)





In addition to significant decrease in number of people employed by agriculture including also active farms, amount of arable land has decreased in Finland during the past decades. In 1967 land area used for agriculture in Finland was 9.0% of all the total land area, whereas in the year 2016 arable land had decreased to 7.39% of the total land area (Trading Economics 2020).

Despite a decrease in number of persons employed by agriculture, active farms, and amount of arable land – productivity has increased in the Finnish farms. The total production of main crops in Finland has increased from 3,615.7 million kilograms in a year at the year 1967 to 4,713.0 million kilograms in the year 2016 (Natural Resources Institute Finland 2020). The raise in the total production of main crops in Finland demonstrates the technological advancements recently made within agriculture.

The northern location of Finland creates an exceptional agricultural environment for the Finnish farmers affecting the national competitiveness of the agriculture sector. Due to the special farming conditions production cost of the Finnish agricultural products is above the European Union's average level. For instance, operating cost for cereals in Finland is estimated 155 EUR per ton according to research conducted by the European Union, whereas the average between the European Union's member states is 118 EUR per ton according to the same research (European Commission 2011). As a result, international competition for agricultural products causes special financial conditions for Finnish farmers requiring better cost efficiency and capital management due to the existing international competition.

International competition that Finnish farms encounter is extensive. Due to low trade barriers volumes of exported and imported food products within the European Union and its trading partners are considerable in size and value allowing price competition in farm products affecting the Finnish farms. For instance, in the year 2016 food imports the European Union's free-trade zone totaled to 93 million tons of food items worth 101 billion EUR. Also, low trade barriers create exporting opportunities for Finnish farms since increasing food exports from the European Union totaled 91 million tons food items worth 84 billion EUR in THE year 2016. (Eurostat 2017)

Food products imported to Finland in the year 2016 in total were measured in value worth 5.98 billion EUR of which the three biggest exporters Germany, Sweden and the Netherlands totaled to 1.22 billion EUR which constitutes to 39% of the total imported food products value to Finland. (World Integrated Trade Solution 2017)



**Figure 3**. Finnish food sector is dependent on imports increasing risk of international production cost related competition.

With proper financial management and cost-efficient usage or resources Finnish farms can stay profitable and manage their financial resources to enable competency against food products and crops imported from abroad.

#### 2.3 Required better management tools for farmers

Resulting from the described matters in section 2.2 the combined effect of the industrialization and internationalization to farm businesses' operating environment together with modern and more advanced intensive cultivation methods set high requirements for modern farmers. Hence, demand for financial planning and budgeting tools which are integrated tinthe agricultural operations and environment is increased as a mean to create and assess suitable information

In subchapter 2.2 described changes have occurred without increase in total returns, which has statistically decreased together with entrepreneurial income which has almost halved during the last ten years (Niemi & Väre 2019, 50-52) As a result, increase for more advanced decision-making process has become imminent to support sustainable growth and ensure better utilization of available funds into profitable operation.

#### **3** THEORETICAL BACKGROUND

#### 3.1 History of accounting

Accounting as a tradition is acknowledged to have been present from the earliest times of civilizations as a mean to record wealth and income, as well trade in addition to levying taxes and other liabilities. Since even the earliest permanent settlements relatively quickly developed into cities with thousands of inhabitants in some areas acquiring wealth in notable speed, the importance of accounting increased as means to gain governmental control in those societies. At the time of Roman era trade had developed to an extent where the total capital had increased significantly, and ownership of private and business property gotten more complex together with more advanced payment models with banking including credit, which required better recording and accounting of monetary transactions. (Giroux 2017, 9-20)

Resulting from the development of efficient mass transportation methods – as for instance railways – in the modern era industrialization started impacting economic development. Development stimulated expansion of successful businesses pursuing economies of scale. Since accounting traditionally had responded to statutory requirements set by legislative parties pursuing governmental interest managers in the late 19<sup>th</sup> century started additionally transforming accounting figures to a form that could be utilized in their own managerial decision-making processes in scientific management movement. (Giroux 2017, 93-96)

Scientific management movement experienced improved popularity during and after the long depression in the United States of America starting with the Panic in 1873. Industrialists started focusing on efficiency of operation and reducing costs with management accounting in pursuit of better level of profitability (Giroux 2017, 97-98, 110). As a result, managerial accounting and cost accounting methods were studied and further developed to be utilized in modelling investment alternatives and forecasting future resources and needs of businesses among other applications. In the current economic environment managing available resources is in the center of production economics. Financial planning and budgeting aim to resolve problems that arise from the fact that future cannot be forecasted based on historical performance but making appropriate suggestions and assessments planning can result in to increased efficiency in using the resources enhancing profitability. In this thesis Becker's (2008) idea of economics being a study of allocating available resources to correspond to the existing and occurring demand is studied further.

Based on the idea of managing available resources the theoretical framework is studied further and utilized for planning a profitability assessment model for farming businesses financial management. Theories and methods of financial accounting, cost accounting, and management accounting are discussed in this thesis, and later flexibly applied into practice when a profitability assessment model is created in chapter 4.

In the profitability assessment developed in this thesis the focus is on creating a structured solution for retrieving and placing financial data and estimates into a model which establishes the net result of the farm business and can be used to evaluate profitability and cost structure. Overhead, labor, material, and cash flow budgets are studied from a theoretical perspective, and a master budget is drawn supporting the financial needs and aspects of a crop farm.

#### 3.2 Branches of accounting

Accounting can be divided into three sub-divisions: financial accounting, cost accounting, and management accounting. Differences between the used methods and tools within the three branches of accounting exists. However, most significant differences can be detected regarding the objectives of financial information and results each type of accounting is intended to produce, as each category of accounting pursues to best provide information for a specific information need. In general, financial accounting practices are determined by the authorities who implement statutory financial liabilities for companies, whereas cost- and management accounting methods can be freely tailored to serve needs of each business or processes without external requirements serving businesses' internal needs. (Lalitha & Rajasekaran 2010)

In sections 3.2.1 to 3.2.3 each branch of accounting is discussed in closer detail, and objectives and differences are explained between the three accounting branches.

#### 3.2.1 Financial accounting

Financial accounting is used to determine profit of an enterprise for the purpose of serving the information needs of proprietors and other shareholders involved, as for instance tax authorities and stakeholders. Financial accounting emphases profitability of a company based on factual expenses, instead of estimates of future predictions. (Arora 2009, 10)

Reporting of financial accounting figures is usually conducted annually and reported according to timetable set by legislation and other regulation representing a true and fair view of an enterprise's income and financial point at the given point of time. Based on the annual result established by utilizing financial accounting methods governments and tax authorities impose liabilities for businesses on issued edicts (Arora 2009, 10-11)

Although financial accounting provides profitability figures it does not meet the needs of managerial decision making than on general level. The main reason is that the financial accounting practices are based on concept of recording historical transactions generating expenses on a company level. Estimating costs and efficiencies of individual processes in a company requires modification of data recorded in financial accounting. However, financial accounting records can be used as a source for management and cost accounting after suitable modifications. (Lalitha & Rajasekaran 2010, 11-14)

Other limitations to using financial accounting in managerial tasks deriving from the objective of recording overall performance based on actual historical values are inability to control usage of materials in production and proper classification of costs. Since costs and incomes are recorded on a general level lacking details financial income records cannot indicate target of different expenses deteriorating the apprehension of financial performance of processes in a company. For instance, equipment maintenance expenses are recorded into a specific account purposed for maintenance expenses, which however does not respond to information needs regarding maintenance costs of specific types of equipment. In relation to the abovementioned limitations, financial accounting cannot provide detailed records for management to assess performance and losses, material control, labor costs, or price fixation and cost comparison. Therefore, financial accounting cannot be utilized by management regarding decisions like investment needs to replace physical labor with machines or robotics, evaluating suppliers, or planning production and forecasting potential income. (Arora 2009, 10-11)

#### 3.2.2 Cost accounting

Cost accounting is a result of more recent development of accounting practices responding to managerial needs in the changing and emerging business environment across industrial and national barriers. It can provide more detailed information to supplement the information of which financial accounting provides in the increasingly more complex operating environment. Cost accounting is well utilized in determining profitability of processes or products and allocating the limited capacity and other resources. Key aspect of cost accounting that it provides detailed information for internal use. (Arora 2009, 11-12)

Cost accounting is a technique that can be used to ascertain costs to determine profit of a product or a service providing information about profit capacity and efficiency of specific operations. Integral part of cost accounting is establishing budgets based on known or estimated costs that are then analyzed to improve utilization of available capital. Determining costs can be done in three ways based on historical costs that have incurred, standard costs, which can be obtained from standards or variances, or marginal costs when fixed costs are charged for a product or service and variable costs are considered as overhead costs (Lalitha & Rajasekaran 2010) Since cost accounting methods can be tailored for individual purposes it can be used as valuable tool for management purposes regardless of external time frames whenever cost data is needed. It can be used in cost control, production planning and evaluating investment needs. However, cost accounting depends on actual figures and costs, which makes it less flexible tool for strategic planning on more general level in contrast of maximizing profits, eliminate wastages, enhance efficiency or to practice inventory control. (Lalitha & Rajasekaran 2010)

#### **3.2.3 Management accounting**

Management accounting is a broad term including many accounting concepts and techniques and it is placed on the highest hierarchy level of the three accounting branches above financial and cost accounting. All data used in management accounting is based on and derives from financial and cost accounting which is then applied through different techniques into a form that can be easily analyzed including forecasts, ratios and cash flow analysis among the others. Main purpose is to produce data that can be flexibly used in management decision-making processes responding to specific information needs to identification, measurement, and evaluation for short-term and long-term strategies. (Lalitha & Rajasekaran 2010)

An integral part of management accounting is providing accounting data and financial information that can be used to conduct business operations more efficiently. This is done by creating budgets and forecasts, which can then be transferred into visual form using statistical tools including graphs, charts and figures in addition to other methods. Reporting schedules and accounting period of management accounting records can flexibly be adjusted based on management's (Arora 2009, 19)

The profitability assessment model is developed as a product of this thesis falls under the management accounting category. It should be regarded as an operative budget providing strategic information on a company's financial position on the future that is reported at least annually but might be done at faster intervals.

The tool is not developed to an extent when it would respond to any statutory requirements and does not help assimilate liabilities related to those requirements like for instance taxes or employer's contributions or payroll taxes. Nor does the tool provide specific methods for determining costs of production units in farm businesses to an exact extent. Instead, the tool can be used to assess profitability of operations on highest level of farm's business operations scaled on yearly basis. Costs and incomes are categorized but not allocated for the production units but instead considers the whole annual production. Therefore, the tool cannot be used in reduction of costs or wastages but serves purpose of examining need for general cost reductions or availability of capital for further investments through general description of business' profitability.

The concept development in this thesis flexibly utilizes different techniques used in financial, cost and management accounting acknowledging the degree of integration of the three accounting branches. Selected techniques are discussed in theory and used in practice in the model, but for the purpose of simplification term management accounting is used in this thesis as a general descriptive term for used techniques and practices.

#### 3.3 Concept of Cost

Profitability of a business is a ratio of generated income in relation to generated costs. Therefore, to assess profitability costs need to be understood and defined to-gether with generated income and income sources. Section 3.3 present definitions of costs utilized in the profitability assessment model created in chapter four. Later budgets that help forming suitable variables for costs are discussed in brief.

Cost has not been defined explicitly with one definition, but instead professionals dealing with cost definition adjust it depending on their needs and situation. Generally, cost can be understood as a price paid for something, but costs can be further divided into many subcategories including for instance:

- Fixed and variable cost
- Material cost
- Labor cost
- Estimated and actual cost

• Overhead cost.

Cost shall not be considered as an expense, since expense is an "expired cost resulting from a productive usage of asset", which can be recorded as such in accounting records of a business. Expenses can be understood as used revenue potential for a utilized asset when producing revenue underlying the historical actualization of cost. (Arora 2009, 25-26)

Costs are measured in appropriate units which is decided based on the needs of ascertaining different costs based on existing circumstances. Unit can be based on production or for a service as for instance kilograms or hours of work.

#### 3.3.1 Variable, fixed and semi-fixed costs

When creating budgets and other financial planning tools understanding behavior of costs in relation to production increase or decrease is important. Three categories can be identified: *fixed costs* which do not change in synchronization with changes in production volume, whereas *variable costs* have high relation to changes in production volumes, and *semi-fixed costs* have both fixed and variable costs' qualities. (Arora 2009, 30-32)



#### Figure 4. Costs behave differently for changes in production volumes.

Examples of fixed costs are for instance rent and leases, salaries of management and permanent staff, and building insurances. Examples of variable costs in other hand are for instance: direct materials and wages, royalties, commissions, or small tools. Semi-fixed costs have usually a fixed cost component which determines the lowest cost level at given product range but might increase after passing a certain level of output, like for instance: telephone expenses, electricity, maintenance, supervision, or indirect materials. (Arora 2009, 31-32)

#### 3.4 Financial budgeting and budget types

A useful way to plan in future for businesses is creating budgets as a supporting tool for scientific management. Budgets can be defined as "a plan quantified in monetary terms prepared and approved prior to a defined period of time, usually showing planned income to be generated and/or, expenditure to be incurred during the period and the capital to be employed to attain a given objective". (Arora 2009, 410)

Budget should be understood as an interpretation of estimated and forecasted income and related expenditure guiding decision making and business or budgetary control. It is meaningful to separate forecasts and budgets. A forecast can be considered as an assessment of possible occurrence of events in future, as a budget should be recognized as a plan which is exercised to meet and achieve a predefined target. (Arora 2009, 411)

Budget preparation is not a standardized procedure but can instead vary notable from organization to organization depending on the information needs. Sources of information for budgets can be documented in various places like accounting records, marketing research, as knowledge of employees and managers. Preparing a budget can require multiple revision times before it can be concluded that a budget is ready for distribution including all variables and components (Needles, Powers & Crosson 2016, 912-913)

Budget types are many and suitable budget should be constructed based related information and planning needs of management. Example budget types intended for different management categories needs are for instance: sales budget, purchases budget, production budget, direct and indirect labor budget, cash budget. Traditionally companies prepare appropriate budgets on assimilated departments within companies and prepared budgets are combined into a master budget providing budgetary control information on a higher level than individual department's budgets, for instance procurement department's indirect purchases budget. (Arora 2009, 414)

Understanding certain types of budgets is important for preparing the model for profitability assessment described in the chapter 4 of this thesis. Sales budget, cost of production, and operating budget are discussed in the following subchapters. Also, a budgeted income statement is explained which is the base for the profitability assessment model developed in this thesis.

#### 3.4.1 Sales budget and costs of production budget

Sales budget presents total estimated sales expressing it with sold units in currency for a period of examination. Difficulties occur with estimating selling price and unit sales, which in case of farm business are variables that encounter constant fluctuation. The equation for determining total budgeted sales is:

#### Total sales = Selling price per unit \* Sales in units

Direct costs of production budget are in close connection to the sales budget, since it estimates the variable costs of production to produce sold units. It can include for instance items and other resources used directly in production activities as goods or utilities, labor, and other costs. (Needles et al. 2016, 913-917)

Direct costs of production = Produced (sold) units \* Direct costs per unit

#### 3.4.2 Operating and other expenses budget

Budgeting operating and other expenses require understanding of the business' operations that are connected to the production. Such costs include both variable and fixed costs deriving from the production activities like indirect purchases of materials, property, and materials. Examples of operating costs are those connected to purchase of energy, insurances, administrative expenses, leasing costs in addition to other meaningful budget components.

#### 3.5 Budgeted income statements and profitability assessment

For this thesis, an income statement is used as a basis for a profitability assessment due to its established form in financial reporting and readability regarding businesses' financial performance. Financial figures to the income statement are retrieved from budgets composed first stages of the budgeting process and in last stages transferred into the form of an income statement.

Income statement can be divided in three components: net income or sales, total expenses, and profit or loss. Income statements vary in length based on statutory requirements for reporting of a business depending on their revenue, number of employees or amount of assets. (Corporate Finance Institute 2020)

Items which are included in a simple income statement are:

- Net sales revenue from sold products where returns, discounts and allowances are subtracted
- Cost of goods sold (COGS) cost of inventories
- Gross margin result when COGS are subtracted from net sales representing gross profit accruing from sales when indirect overhead costs are not considered
- Operating expenses indirect expenses related to production of goods or services which cannot be allocated as COGS
- Other expenses costs which are not regarded in COGS or operating expenses, for instance interest expenses
- Total expenses Total when operating expenses added to other expenses
- Profit or loss before taxes gross margin subtracted by total expenses
- Tax payable total of tax liabilities to be paid for tax authority
- Net profit or loss profit or loss before taxes subtracted with paid taxes. Represents surplus which a company can create from its operations which can be transferred to company's assets or distributed to owners. (Bangs 2010)

Based on each business' needs the income statement used in budgeting purposes can be modified to meet the information needs of the decision-making process and to forecast future performance. Variables to any category of income or cost can be added or removed to get a suitable view of the annual overall financial performance of a company. Historical values to the modified income statement can be retrieved from financial accounting records and forecasted periods can be based on academic research or other estimates. Estimates can be based on separate budgets providing information required information and financial information. (Corporate Finance Institute 2020)

Once a budgeted income statement has been prepared it can be analyzed using for instance different ratios and other management accounting tools like trend analysis to build a better picture of the company's forecasted financial performance. Useful ratios for analyzing a budgeted income statement are among others gross profit ratio, net profit ratio, and expense ratio.

#### **4 REPORTING THE FINANCIAL MODEL**

This section reports the developed profitability assessment model intended for scientific management on Finnish crop farms in detail. Scope of description is limited to illustrating the logic of calculations and relations between values and results, which could function in a manner of a flow chart if a computer software based on the described model were to be developed an made available for farm managers' use. Appendixes 1-3 include visual representation of the model in general terms using a spreadsheet representation. The details of the model are further discussed in writing in subchapters 4.2 to 4.6.

#### 4.1 General structure of the method

The profitability assessment model's object is to present farm's profit-making capacity during period of six years. The timeframe considers two previous years, which values derive from historical data and financial performance of the company, and four years' forecast regarding financial performance. Categorized costs from farm operations are subtracted from revenues deriving from farm's operations on annual level to estimate generated profit that can be directed to new investments or to owners.

Two past years data is applied to the assessment model to receive better comprehension of the current financial situation and establish reference for the future estimates. Values for the previous two years can be retrieved from the farm's statutory financial accounting and from cost accounting records in case such have been sustained.

Future estimates in the profitability calculation and assessment are based on investment plans and other budgetary decisions of the farm manager. The assessment of the farm manager is a possible source for input values to the assessment model in addition to the retrievable values from planned investment policies. Other recommended sources for retrieving reliable data for estimating costs, income, and other necessary variables are trusted external sources producing relevant statistics like national natural resources institutes, academic research papers and statistics, or professional literature.

The established profitability assessment model considers income and costs annually. The model is created based on a structure where growing season of plants starts in spring at the time of planting and ends in fall for harvest, and all costs and income are allocated to the year of production. Cost of inputs needed for cultivation of crops are allocated to the season where they are utilized to produce harvest and each season's harvest income is in similar manner allocated to the same year.

It is recognized that production inputs can be procured in a different year than those that are used for producing harvest, and harvest can be sold during the upcoming years changing timing of actual occurrence in cash-flows. However, in this model cost is considered to the same year as its use in production for the purpose of simplicity exclude need for assessing impact of estimated time of cash-flows' occurrence.

To increase logicality and structure of the model and data gathering process, inputting values and estimates to produce profitability assessment according to the model are divided into two main steps. The purpose is to create a model that would guide user through multiple episodes in a structured form. In a such manner, the user first assesses relevant details in discipline. After that, the individual values, estimates, and investment plans are systemically and in an automatic manner transferred into a general presentation of profitability in a standard template of an income statement, as shown in Figure 3. **1.a** Estimate fixed and variable costs.**1.b** Plan investment actities affecting variable and fixed costs



2.a Area used in production for each crop is planned, and affected income determined.2.b Amount of other income are determined.



Figure 5. The user is guided through the process in a structured manner.

The core concept of the model is to create a method in which a user can operate with guidance even in situations where the user's financial understanding is not on a high level by providing necessary information. For instance, the user is guided in a case when data should be retrieved from financial accounting records to establish relevant income and costs for two historical years which the model considers. Guidance could be given in a finished application using dialog boxes and providing guidance in written forms via available methods in software programming.

However, to ensure reasonable scope for this thesis matters outside the profitability calculation logic to produce a budgeted income statement are not considered. Illustrations can be provided in addition to written description to help the reader to better understand function and logical mechanism of described part of the explained profitability calculation tool.

Under the following subheadings 4.2-4.7 the two stages to be executed in the profitability assessment process are presented and described in detail.

#### 4.2 Stage 1.a: General fixed and variable costs

In the first stage the user determines fixed and variable costs of the farm for the period of examination for the categories presented in Appendix 1. Values for the previous years can be retrieved from the previous years' financial or cost accounting. Historical expenses can be used as a reference for the future estimates which

the user makes. Adding cost categories should be made available to meet possibly varying categorization needs of each user.

Default categories to be estimated or retrieved from previous cost accounting or financial accounting recordings included in the calculation are:

#### Fixed costs and semi-fixed costs

- Maintenance cost machinery
- Maintenance cost facilities
- Leasing costs of facilities, machinery and equipment
- Leasing costs of arable land
- Insurances
- Administrative costs
- Other fixed costs

#### Variable costs

- Energy costs (fuel and electricity)
- Labor costs
- Entrepreneurs desired salary
- Other variable expenses
- Taxes

#### 4.3 Stage 1.b: Investment planning affecting variable cost

The second stage of preparing financial figures for the profitability calculation is planning major investments on the farm considering machinery, equipment, facilities, and land. In the case all machinery, equipment, property, and land purchase costs and investments are considered as variable costs since those create negative cash outflows and create no defined explicit return other than when used in production. Default categories included in the calculation are:

- Purchases machinery and equipment
- Purchases facilities
- Purchases land and forest

The above categories' expenses should be estimated and established case by case and directed to the correct cost category. The suggested method for establishing the costs is to create a view where a user can add investments one at the time and based on investment type incurred costs wo

Invetment type	Description	Budgeted price per unit	Number of units	Investment year
Land	Arable land	10.000 €/ha	3	3
Machinery	Telehandler	60.000€	1	1
Facilities	Silo extension	20.000 €	1	2
+ Add row		en en la construction de la constru La construction de la construction d	÷	\$ \$

**Figure 6**. Investments are recorded individually and transferred to correct category in the profitability assessment.

Estimates should be made for the purchase prices of planned investments. Machinery and equipment costs can be estimated, for instance, by researching listings of equipment on sale, and prices of investments for facilities can be approximated, for instance, from extracts from the Official Purchase Price Register. Farms can also acquire more land to expand their operations or decrease available arable land for production by selling fields. Price of arable land has regional variation in addition to the land's qualities affecting sale price. A user should make estimates for the average price of land price per hectare based on his requirements regarding intended purchase of new arable land, and regional statistics available for sale transactions of land areas from National Land Survey of Finland.

## 4.4 Stage 1.c: Report of loans for interest expense calculation

In the third stage user fills in the total sum of all loans linked to the agribusiness and those loans' average interest which are recorded on company's balance sheet. Although loan repayments are not considered in the profitability calculation, repayment schedule should be considered, and the total sum of loans and their average interest percentage should be adjusted for each year based on the decreased loan capital as an effect of loan repayments.

If new loan is known to be raised, for instance to finance a planned investment, their effect on the total sum of loan capital and average rate should be estimated and

transferred into the profitability assessment model affecting the interest expenses category in the model.

#### 4.5 Stage 2.a: Crop planning & estimating farm income

Crop planning is conducted in farms to select and allocate available arable land for crop production based on land qualities and strategic objectives of the farm. Modern agriculture strives to enhance ecological sustainability by practices crop rotation using multiple varieties and sort of crops actively farmed on fields to ensure long-term fertility, reduced need for synthetic chemicals, improved soil structure with increased resilience for poor environmental conditions, economic viability, and reasonable biodiversity (Boyabatli, Nasiry & Zhou 2019). The crop planning affects farm income through production crops, since harvest size and price vary considerably between crops. Therefore, it is important to estimate the potential generated income of the intended cropping plan, instead basing farm income on previous year's historical sales volumes and prices that might have occurred when different crop planning strategy had been executed.

The user should estimate the cultivated area for each crop farmed on the farm for the duration which forecast comprehends according to the cropping plan made for agricultural purposes. Using values of a cropping plan and areas for each crop of which income per production unit has been estimated in stage one it is possible to get estimates for the total income from sold harvest with the expectation that complete harvest is sold within the production year modelling the direct impact on business' cash flows.

The cropping plan should consider any changes in the amount of arable land on the farm. Therefore, the user should include plans to buy or sell the farm's arable land and increasing or decreasing area of leased fields in active farming when establishing income from the established crop planning.

For each crop produced on farm an estimated *yield level* is estimated in tonne per hectare unit. For instance, statistically yield for wheat in Finland in the year 2019

was 4,56 tonne per hectare (OSF 2020a). The annual income of the cultivated hectare per crop is then estimated based on assumed value of the crop's producer prices per tonne from year to year. Average prices in Finland are collected and made available by OSF. Since annual yields and selling prices are depend on planting, growing and harvest seasons conditions, supply and demand, among other external factors farmers cannot affect values from previous years can be used as predictions for future values and annual changes might be left unconsidered.

Seeds, fertilizers, and cost of pesticides in euros per hectare form a part of the variable cost on land farmed for production crop. Since the above-mentioned costs vary between production crops, the user of the budgeting tool should establish estimates for each crop individually based on previous cost accounting records or estimated using another appropriate method. Established average cost shall then be applied to profitability calculation when determining variable cost of each crop's production per hectare.

On a typical privately own farm in Finland work is often performed by the entrepreneur in addition to external labor. Farmers as entrepreneurs have the possibility to affect the amount of work they perform and the amount of income they raise from the farming operations as salary. Also, the need for external workforce might vary based on cropping plan and allocation of arable land to different crops in addition to high seasonality of required external work input on crop farms. Based on previous cost accounting number of working hours and cost of working hour should be established in the first phase of the budgeting process for each crop type produced on the farm for both internal and external workforce.

Values can be based on actual figures derived from a farm's previous year's cost accounting if suitable variables have been recorded. Another method is using the farmer's educated estimate based on previous experiences if matching variables are not available from previous cost accounting. Risks involved in using estimated need to be considered and as a reference suitable research material can be used to evaluate accuracy and reliability of the made estimates and suitable resource for Finnish farmers can be, for instance statistics collected by Luke - Natural Resources Institute of Finland or OSF - Official Statistics of Finland on their websites. Making accurate estimates for base values is important for the reliability of results.

#### 4.6 Stage 2.b Estimating other income

Farms can have other sources of income than sale of main production crops. When creating a profitability calculation all sources of income should be included and categorized appropriately. Therefore, the farm manager should estimate the generated income from based on the best available knowledge on:

- Contracts income
- Sold forest
- Sold wood
- Sales facilities
- Sales machinery and equipment
- Other agricultural subsidies

to be included in the profit assessment as income.

#### 4.7 Stage 2.c Returning to estimating fixed and variable costs

In stages 1.a-1.c the user has forecasted the fixed and variable costs of the farm business. However, the user should return to the estimated costs to account for the changes made regarding fixed and variable costs. Investments might have established a need for increasing the total sum of estimated costs in some categories, for instance, larger cereal harvest based on the established cropping plan might increase the need for petrol and energy used in drying the harvest.

#### 4.8 Values transferred into profitability statement

After all estimates and values are established in the stages 1.a-2.b, a profitability statement is automatically constructed based on links created to the figures of pre-

vious stages. The profitability statement constructed in this thesis follows a common structure of the income statement used for reporting businesses income, costs, and net profit from the operations.

Firstly in the model all types of income from the farm operations and other businesses are presented, based on which the total income is calculated. All revenue sources (1.1.-1.5.) from the sale of production crop, sold machinery, equipment and facilities, in addition to other income from any conducted business which is regarded on the farm's accounts is totaled together with agricultural subsidies to *total income (2.)*. From the total income *total cost of production (3.)* is subtracted to receive gross margin (4.). All costs established in the earlier stages including *operating costs (5.)* and *other costs (6.)* are added together forming *total costs (7)*. *Operating profit (8.)* can be calculated by subtracting total costs from gross margin. After removing value of *tax liabilities* from operating profit *Net profit (9.)* can be determined.

The structure of the forecasted income statement in the created profitability assessment model is as follows:

#### 1. <u>Generated Income</u>

- 1.1. Sold production crops
  - 1.1.1. Crop 1
  - 1.1.2. Crop 2
  - 1.1.3. Crop 3
- 1.2. Sold machinery and equipment
- 1.3. Sold facilities
- 1.4. Other income
- 1.5. Agricultural subsidies

## 2. Total Income

#### 3. <u>Total cost of production</u>

- 3.1. Total cost of seeds, fertilizers and pesticides
- 3.2. Total labor cost of production
- 3.3. Other costs of production

### 4. Gross margin

## 5. **Operating costs**

5.1. Maintenance cost - machinery

- 5.2. Maintenance cost facilities
- 5.3. Leasing costs of facilities, machinery and equipment
- 5.4. Leasing costs of arable land
- 5.5. Energy costs (fuel and electricity)
- 5.6. Insurances
- 5.7. Labor costs
- 5.8. Administrative costs
- 5.9. Other operating expenses

### 6. Other costs

- 6.1. Purchases machinery and equipment
- 6.2. Purchases facilities
- 6.3. Interest expenses
- 6.4. Entrepreneurs desired salary
- 6.5. Other expenses
- 7. Total costs
- 8. Operating profit
  - 8.1. Paid tax liabilities
- 9. Net Profit

#### 4.9 Using budgeted income statement in assessment of profitability

Established values are presented in the similar format as shown in Appendix 3, for the considered period of six years including two years' historical data and four years' forecast. Incomes and costs for each category are presented on the corresponding row to track occurring changes.

When assessing a farm operations' profitability based on the established framework multiple variables should be accounted for analyzed. First and foremost, it should be assessed if the operations can produce net profit, and what is the trend regarding the development of net profit. To assist in the analysis income statement related ratios like net profit ratio can be utilized to enhance the impression of the profitability.

Based on the evaluations of the farm manager, adjustments to the farm's financial strategy might need to be made to ensure economically sustainable operations. For example, in case of a low net profit margin it needs to be investigated if income can

be stimulated with reasonable investments not affecting liquidity, or if cutting costs and delaying investments is required.

### 5 CONCLUSION

The operating environment of businesses is constantly changing and increasing in complexity. Also, the agribusiness encounters the same challenges as other industries demanding higher managerial ability from farmers to ensure profitable and financially sustainable operations together with ecological sustainability.

Agricultural farming in Finland has experienced major changes where unit sizes of farms have gradually increased and decreased in number as international competition on the Finnish food market continues to affect local financial conditions. Technological advancements have enabled higher efficiency and productivity on farms requiring less labour force whereas farms operate with much higher capital requirements today. Since the financial volumes have increased in the farming management of financial capital grows in importance requiring methods and tools for financial controlling.

In this thesis a profitability calculation model was developed to be used on Finnish crop farms to critically assess their operations from the financial standpoint according to the scientific management practices. Using the model is divided into three stages where a user first estimates the occurring fixed and variable costs. In the second stage the farmer establishes estimations for forecasted income and revenue on the farm based on the conducted crop planning affecting possible revenue generation based on variation between profitability of different production crops per units of cultivated land. Also, other income from the farm operations are estimated in the second stage. Based on the estimated costs and income in the third stage values are transferred into a financial model in a form of a budgeted income statement. The budgeted income statement presents income and costs on an annual level in each category from farm operations.

The information presented in the budgeted income statement can be used by a farm manager to assess the farm's financial profitability and overall performance. The model can be used to forecast revenue, costs, and profit from farm operation for the four following financial periods.

#### 5.1 Limitations to the developed profitability model

The developed financial model has some notable limitations related to the extent of financial information which the model comprehends. For instance, the establishment of costs and income at the model's current position does not support the user to a preferred extent as the values need most often to be estimated based on financial expenses and financial accounting records. Also, the model does not cover statutory requirements like income tax, value added tax or employer costs as an in-built feature determining them based on the estimated performance which the model presents. Therefore, the user of the model is required to complete assistive calculations to determine some of the variables since resources reserved for the thesis did not allow development of more advanced features for matters as described above.

#### 5.2 To be developed further

Financial planning and budgeting are constantly executed by farm managers and farmers. However, tools for profitability assessment models and other tools for evaluation of financial outcomes can be further developed. Development of models integrating financial performance further to a farm production planning can provide valuable information for farm managers. Also, models considering taxes payroll expenses, and other statutory expenses can be developed to increase information accuracy as well data granularity together with visual representation of results in order to enhance the financial decision-making processes on farms.

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## APPENDIX 1

Table 1. Determining fixed and variable costs from farm operations.

Year	-2	-1	0	1	2	3
Stage 1.a General fixed and variable costs						) () ()
Fixed costs and semi-fixed costs						
Maintenance cost - machinery	2	6 - 38 		6 88 		6 - 55 
Maintenance cost - facilities						
Leasing costs of facilities, machinery and equipment						
Leasing costs of arable land						
Insurances				6. 83		S. 33
Administrative costs				( ) (		
Other fixed costs						
Variable costs						
Energy costs (fuel and electricity)					,	6 - 28 
Labor costs						
Entrepreneurs desired salary						
Other variable expenses						
Interest expenses			, 			
Stage 1.b Investment planning for variable costs						
Purchases - machinery and equipment					· · · · · · · · · · · · · · · · · · ·	6 - 55 
Purchases - facilities		2 (A) 2 (A)				
Purchases - land and forest						
Stage 1.c Report of loans for interest expense calculation				6		C 38
Total sum of loans (loan 1, loan 2, loan 3)		2				
Aveage interest -%						

# STAGE 1. Fixed and variable costs

APPENDIX 2

Table 2. Determining income from farm's operations.

office at crop planning a countrating income north narves	STAGE 2. C	rop p	lanning	& estimating	g income	from h	narvest
---	------------	-------	---------	--------------	----------	--------	---------

Year	-2	-1	0	1	2	3
Stage 2.a Crop planning and estimating farm income		8	12	1	10	
Crop 1:						
Estimated harvest (tonnes/ha)						
Cost of seeds, fertilizer and pesticides (€/ha)						_
Estimated amount of required external work (hour/ha)						
Estimated amount of cost per working hour (€/h)						_
Estimated selling price (€/tonne)						
Estimated crop specific agricultural subsidies (€/ha)						
Crop 2:						
REPEAT						
Crop 3:						
REPEAT						
Arable land (ha)	ľ	Ĩ	T.			
Changes in arable land owned (ha)						
Changes in aralble leased land (ha)						
Arable land in total (ha)						
Production crop (in ha): 1 (potato)						
Production crop (in ha): 2 (wheat)						
Production crop (in ha): 3 (barley)						
(Un-used arable land)						
Stage 2 h Estimating other income	P.	-	P		- P	-
Contracts income	8	2.5	2	2	2	3
Sold forest	8	z,	2		2	ŝ
Sold wood	2	2.6	2		2	
Solar - forilities	Š.	8	ž	0	ž.	- 0
Sales - rachinery and equipment	ŝ.	8	ž.	0	ž.	ĝ
Other paricultural subsidies	8	0	Š.	0	ž.	

# **APPENDIX 3**

Table 3. Budgeted income statement.

Year	-2	-1	0	1	2	3
Generated Income	-	-			-	
Sold production crops		S. 38		S. 38		Q - 39
Crop 1		8 - B		6 - B		
Crop 2						
Crop 3		e				
Sold machinery and equipment						
Sold facilities		5 is.	-	5 55		S
Other income	-	5 6.	-	5 (5)		S
Agricultural subsidies		5		5		S
Total Income		8		5		6 88
Total income		e 18		e (8		A
Total cost of production						
Total cost of seeds, fertilizers and pesticides		2		2		·
Total labor cost of production		5 - 53	-	5 5		5 52
Other costs of production		5	-	5 S	-	5
Gross marain		S		6		6
oross margin		8 - 18		2		10 C
Operating costs						
Maintenance cost - machinery	-	5 - S.	-	6 S.		
Maintenance cost - facilities		2 33	-	2 Bi	-	2 22
Leasing costs of facilities machinery and equipmer	nt	ý (ř.	-	7 58		2
Leasing costs of arable land		2 (A	-	7 50		2
Energy costs (fuel and electricity)		2 32	-	÷ 8		2 10
Labor costs						
Administrative costs		(		- 8		
Other operating expenses		<u>i</u>		1		
Other costs		6 6				
Purchases - machinery and equipment		÷				-
Purchases - facilities						
Purchases - land and forest		2		2		
Interest expenses		2		2		-
Entrepreneurs desired salary		2		2		-
Other expenses						
Total costs						
1000 (030)						
Operating profit						
operating project						
Paid tax liabilities						
Net Profit						
Annual cash requirements						
Cash - opening balance						
Cash flow surplus / deficit						
Loan payment						
Required financing in EUR						