The Impact of Digital Financial Services on the Profitability of Agriculture Enterprises: A Comparative Study in Indonesia and Hungary

Doctoral (PhD) Dissertation

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1. INTRODUCTION

Digital transformation affects all business sectors, including agriculture. The agriculture sector is commonly faced with problems such as production capacity, access to markets, trading positions, and higher incomes. Digitalization is a driving force for agriculture enterprises to keep up with the trend. When provided with DFS, agriculture enterprises will benefit from improvements in income, management, and economic resilience.

Agriculture enterprises are struggling with the application of DFS for their operational activities. The development and commercialization of agriculture require financial services that can support the sector. In most cases, there is a lack of investment from financial institutions or financial providers to provide the access to financial services that could facilitate agriculture enterprises. DFS in agriculture enterprises could have a more significant role to increase the profitability.

The purpose of the dissertation is to explore with a sample of agriculture enterprises in Indonesia and Hungary about the application of DFS in daily operations and whether DFS application makes a difference in profitability. The dissertation uses quantitative methods to give an insight about the problem.

2. RESEARCH OBJECTIVES AND RESEARCH QUESTIONS

2.1 Research objectives

This dissertation renews a theme on which some previous research had been undertaken with the aim of understanding the determinants of DFS and the application in enterprises. Specifically, this dissertation

aims to find out how DFS, given the digital and agriculture landscape in Indonesia and Hungary, could have an impact on the profitability of agriculture enterprises. As there are no previous studies comparing on how DFS could affect the profitability of agriculture enterprises in a developed country (Hungary) in contrast to a developing country (Indonesia), this dissertation is intended to fill in the research gap. The research objectives are as follows:

(1) To identify and map significant factors to the application of DFS in agriculture enterprises;

(2) To find out whether the application of DFS, given the digital and agriculture landscape in Hungary and Indonesia, could have an impact, or significance, on the profitability of agriculture enterprises.

2.2 Research questions

The purpose of the dissertation is to find out factors in DFS and the impact of DFS in the profitability of agriculture enterprises. This dissertation should enable a better understanding of the needs of the business, the challenges, and the academic foundation based on theories and concepts. The following questions are stated as follows:

RQ1: What are the factors affecting the application of digital financial services in agriculture enterprises?

RQ2: In the real situation, is there an impact on the profitability regardless of the agriculture enterprises use or do not use digital financial services?

RQ3: What suggestions are useful to bridge the gap between DFS application and increasing the profitability in agriculture enterprises?

Each research question (RQ) stands independently, nonetheless there are links between them. The first RQ is the first step in the dissertation, as a preliminary mapping of the DFS situation. The second RQ intends to find out the impact of DFS on profitability. The third RQ are suggestions to practical solutions on using the existing DFS system for improvements.

3. METHODOLOGY

The analysis for this research uses an empirical research, which is based on observation and measurement of phenomena, as directly experienced by the researcher. The research questions aim to find out the impact of digital financial services (DFS) on the profitability of agriculture enterprises, comparing Indonesia and Hungary. The data gathered may be compared against a theory or hypothesis, but the results are still based on real life experience. The type of data required for this research is quantitative data, which consists of primary data from surveys, and secondary data from agriculture databases in Indonesia and Hungary to support the theoretical background. This is the most suitable approach to answering the research question as numbers are measurable, and would result in an objective conclusion.

3.1 Hypotheses

Based on the literature review and the research questions, the hypotheses were constructed as follows:

H_{01}: There is no impact in the application of DFS on the total revenue of
agriculture enterprises in Indonesia

H_{A1}: There is an impact in the application of DFS on the total revenue of
agriculture enterprises in Indonesia

H_{02}: There is no impact in the application of DFS on the total revenue of
agriculture enterprises in Hungary

H_{A2}: There is an impact in the application of DFS on the total revenue of
agriculture enterprises in Hungary

H_{03}: There is no impact in the application of DFS on the total variable
costs of agriculture enterprises in Indonesia

H_{A3}: There is an impact in the application of DFS on the total variable
costs of agriculture enterprises in Indonesia

H_{04}: There is no impact in the application of DFS on the total variable
costs of agriculture enterprises in Hungary

H_{A4}: There is an impact in the application of DFS on the total variable
costs of agriculture enterprises in Hungary

H_{05}: There is no impact in the application of DFS on the gross margin of
agriculture enterprises in Indonesia

H_{A5}: There is an impact in the application of DFS on the gross margin of
agriculture enterprises in Indonesia

H_{06}: There is no impact in the application of DFS on the gross margin of
agriculture enterprises in Hungary

H_{A6}: There is an impact in the application of DFS on the gross margin of
agriculture enterprises in Hungary

3.2 Research design

The dissertation used an empirical research, which is based on observation and measurement of phenomena. The dissertation used a quantitative method, which emphasizes objective measurements and the statistical, mathematical, or numerical analysis of data collected through polls, questionnaires, and surveys, or by manipulating pre-existing statistical data using computational techniques. Overall, a quantitative

research study is to classify features, count them, and construct statistical models in an attempt to explain what is observed. Quantitative research designs can be descriptive, where subjects are usually measured once, or experimental, where subjects are measured before and after a treatment. A descriptive study establishes only associations between variables; an experimental study establishes causality. This study involves a descriptive study from the conducted survey to find out about the association between variables, and also an experimental study whether DFS has an impact or not on profitability.

Table 1. Summary of methods to obtain information

No	Research question	Information needed	Method
1	What are the factors affecting the application of digital financial services in agriculture enterprises?	Respondents' answers to the survey questions, which consist of 23 questions and divided into 3 parts: socio-economic, agriculture enterprise, and DFS sections.	Primary data analysis using survey
2	In the real situation, is there an impact on the profitability regardless of the agriculture enterprises use or do not use digital financial services?	From the KSH (Hungary) and BPS (Indonesia) databases for total revenue, total variable costs, and gross margin, from 2014 to 2019.	Secondary data analysis using profitability measurements
3	What suggestions are useful to bridge the gap between DFS application and increasing the profitability in agriculture enterprises?	Some questions in the survey that ask for opinions in the form of multiple choice	Results from survey and profitability analysis

Source: Constructed by researcher

The survey collected 284 respondents through online questionnaires in Indonesia and Hungary, with 183 respondents from

Indonesia and 101 respondents from Hungary. The target population was determined using a 95% confidence level and 5% confidence interval. The survey was intended to make a mapping about DFS factors associated with agriculture enterprises in Indonesia and Hungary. In order to support the survey, secondary data, i.e. profitability, with total revenue, total variable costs, and gross margin as the measurements, were taken from national databases (i.e. KSH and Indonesian Bureau of Statistics) to answer hypotheses questions. The profitability data was taken under a 6 year time frame from 2014 to 2019 for both Indonesia and Hungary, and all the currency data has been converted into euros.

4. RESULTS

The results of the survey and the secondary data analysis are summarized below.

4.1 Questionnaire analysis

The chi-square test of independence determines whether there is an association between categorical variables (i.e. whether the variables are independent or related). The chi-square test is useful when analyzing cross-tabulations of survey response data and it informs researchers about whether or not there is a statistically significant difference between how the various segments or categories answered a given question. The survey was conducted to provide an overview or preliminary mapping about the respondents' view based on the questionnaire, which are divided into three parts: socio-economic aspects, agriculture enterprises and farming activities, and DFS. The survey is distributed to respondents in two countries, Indonesia and Hungary.

Table 2. Findings from the questionnaire analysis

No	Section	Findings
1	Socio-economic	All variables are significant.
2	Agriculture enterprise and farming activities	All variables are significant except for: 1. Main agriculture product 2. The agriculture enterprise does not offer a good service for members 3. The agriculture enterprise does not provide a stable market price The main constraint for agriculture enterprise and farming activities is government interference that has a negative effect on agriculture development. The main constraint for agriculture enterprise and farming activities in Hungary is inadequate capital.
3	DFS	All variables are significant, except for: 1. Owning a bank account 2. Banks not deliver greater value 3. Banks are not transparent in costs/fees 4. Banks do not know what the customer needs 5. The frequency of using bank call centers is low or non-existent 6. Reports for lost/stolen debit/credit cards The top three important features for DFS development in Indonesia are: 1. Stronger online security 2. Cost/fees of making the transactions 3. More features in online banking and mobile apps The top three important features for DFS development in Hungary are: 1. Stronger online security 2. Cost/fees of making the transactions 3. Easier login/authentication process

Source: Constructed by researcher

4.2 Hypotheses analysis

The hypotheses are analyzed using a linear regression method, with a confidence level of 95%. The table presents the summary of the acceptance of the hypotheses.

Table 3. Findings from the hypotheses analysis

No	Hypotheses	Result
1	H_{01}: There is **no impact** of DFS in the **total revenue** of agriculture enterprises in Indonesia	**Accepted**
2	H_{A2}: There is **an impact** of DFS in the **total revenue** of agriculture enterprises in Hungary	**Accepted**
3	H_{03}: There is **no impact** of DFS in the **total variable cost** of agriculture enterprises in Indonesia	**Accepted**
4	H_{A4}: There is **an impact** of DFS in the **total variable cost** of agriculture enterprises in Hungary	**Accepted**
5	H_{05}: There is **no impact** of DFS in the **gross margin** of agriculture enterprises in Indonesia	**Accepted**
6	H_{A6}: There is **an impact** of DFS in the **gross margin** of agriculture enterprises in Hungary	**Accepted**

Source: Constructed by researcher

For Indonesia, there is no impact in the application of DFS on the total revenue, total variable costs, and gross margin of agriculture enterprises. While in Hungary, there is an impact in the application of DFS on the total revenue, total variable costs, and gross margin of agriculture enterprises. This is caused by the low and relatively constant percentage of DFS use in agriculture enterprises in Indonesia, and the main issues for the low usage of DFS are as follows:

1. Although the development of internet is very fast with a growing number of internet users annually, the application of DFS is more widespread in urban areas compared to rural areas, where agriculture enterprises are mostly located. Some farmers mentioned that they would like the agriculture enterprise to provide with education and training for digital farming.

2. DFS in agriculture enterprises are still in development, and some are still in tryouts for smallholder farms up to 5 hectares of farmland area. In addition, smallholder farmers think neither sources of funding from physical banks nor through DFS have made any difference.

3. There are also structural problems, such as (a) the dissemination of information to rural areas and communication problems between the bank and the agriculture sector, (b) the difference in funding schemes for modern agribusiness corporations versus smallholder farms, and (c) financial policies from banks that do not support the agriculture sector.

4.3 Answers to research questions

No	Research question	Answer
1	What are the factors affecting the application of DFS in agriculture enterprises?	Socio-economic factors (gender, age, education, etc.) are significant factors. Agriculture enterprise and farming activities are also significant factors. DFS are also significant factors. It could be highlighted that Indonesian respondents mostly use mobile apps while in Hungary the majority uses online banking. Bank services are a concern to respondents in both countries.
2	In the real situation, is there an impact on the profitability regardless of the agriculture enterprises use or do not use digital financial services?	For Hungary it is obvious that DFS has an impact on profitability and that a system called ARDA has been implemented for the agriculture sector and used in daily operations. For Indonesia, the application of DFS has no impact on profitability, even though such system has been implemented in some regions. DFS in rural areas are not widespread and farmers need to be educated in their digital skills.
3	What suggestions are useful to bridge the gap between DFS application and increasing the profitability in agriculture enterprises?	The majority of farmers in Hungary are assisted of fully served by the state village agents' network and the private networks. The role of agriculture enterprises is still very much in place for education and training purposes, despite the negative image. Such implementation in Indonesia can be done through the existing DFS system and additional training to the farmers through the agriculture enterprises as means of connecting farmers with technology.

Source: Constructed by researcher

4.4 Limitations

In the framework of the research, there is a constraint in the definition of agriculture enterprises. According to literature, it can take many forms, and it also differs among countries. To provide a general understanding about the research, the term "agriculture enterprises" is applied to all types of business forms involved in agriculture, including cooperatives.

Another limitation is the use of gross margin as a profitability measure. Gross margin can be used as a planning tool in evaluating the potential value of alternative technologies and/or enterprises. It helps farmers for decision making about their future farming activities and about opportunities as they present themselves. Gross margin is especially helpful for less literate and numerate farmers to make comparisons; this will assist such farmers in taking better decisions about their farms. Although gross margin is commonly used in decision making, it is not the best measure of profitability of a company as a whole because it excludes many costs such as financing costs and overhead expenses. DFS application clearly affects agriculture overhead costs, unfortunately the secondary data provided by the agriculture databases do not include details for the overhead costs.

For the survey, it was relatively easier to get respondents from Indonesia compared to Hungary. One main constraint in getting Hungarian respondents in Hungary was the language. Even though the survey questions have been translated to Hungarian, convincing people to fill in the online survey proved to be difficult. The constraint for Indonesia is that the target respondents usually work in the rural areas and therefore may not be able to fill in online surveys. It is required to meet face-to-face meetings with these people, and the researcher only spent two months' time in Indonesia during the study period, which was insufficient to go to rural areas and organize

direct interviews on the survey. The data collected in the survey is mostly conducted from online surveys in several agriculture cooperatives in the area where the researcher lives, and it was a bit difficult to get feedback from online surveys.

5. SUMMARY

The analysis of DFS impact in profitability reveals that the application of DFS in agriculture enterprises has an impact on profitability. This makes sense in the comparison of Indonesia and Hungary. The survey supported the theses, where it gave indications that DFS in Indonesian agriculture sector is still in its preliminary stage and not widely used, while in Hungary, DFS is applied in the agriculture sector for most of the daily agriculture operations. The challenge of DFS development for Indonesia and Hungary is to use mobile apps to be more cost-efficient, and it is an opportunity for the internet or phone providers to expand the scope of internet infrastructure to reach the rural areas with lower subscription rates.

The research does not state that DFS in agriculture must lead to positive impacts regardless of geographic location or other factors. At the same time, there are reasons to be optimistic as encouraging trends continue to emerge across a range of market contexts. The main motivation for this research comes from a practical value of promoting deeper comprehension and capacity to better serve the agriculture sector through DFS offerings in the markets where they operate. The practical implication is that this research can be used as a reference for decision makers to facilitate the process of rejuvenating agriculture enterprises with supporting incentives and regulations. In addition, this research could help the idea to build further

research in the agriculture sector so that agriculture enterprises remain relevant to the changing times.

6. NEW SCIENTIFIC RESULTS

From the results it can be concluded that agriculture enterprises can utilize the potential of DFS to reduce distances between financial institutions and the location of the agriculture regions, especially in rural areas, enabling transactions at a reduced cost relative to conventional bank operations. DFS represents an opportunity for efficiency through cost reduction and increase the profitability for the agriculture enterprise.

1. Famers in Indonesia and Hungary lack reliable, cost-effective methods for storing, transferring, or moving funds, focusing more on cash-based transactions. **Access to digital technology is made possible only via mobile devices, which are usually low-cost basic or feature phones.**

2. As the DFS in the agriculture sector in Indonesia is still in its preliminary stage, introducing smallholder/family farmers in Indonesia to **digital payments** is one step towards digitalization. This is also applicable to Hungary. The survey showed that sources of funding for agriculture enterprises mainly come from private banks (Indonesia 51%, Hungary 85%). This is an advantage for private banks to reach this agriculture customer group. Particularly in rural area, payment service providers (banks) and mobile money operators (phone and internet providers) could integrate payment platforms to the rural economies by adding value to DFS offerings targeting the agriculture sector. As a consequence, **digital payments are the crucial step to provide DFS in a sustainable, profitable manner**.

3. The survey showed constraints to overcome in agriculture enterprise development. Governments and international stakeholders have important roles to play in agricultural productivity, efficiency and resilience to the stress of climate change, the private sector and especially financial service providers are essential. The government, particularly ministries of agriculture and finance, should include in their policies to develop agriculture areas (i.e. rural areas), which is more achievable in the short run. **Policies to reinforce DFS and improving farmers' skills** to manage production will be a contribution to long-term agricultural productivity growth and poverty reduction.

4. Based on the results of the hypotheses analysis, there are 4 factors that influence the impact of DFS in agriculture enterprises: adoption level of DFS, total revenue, total variable cost, and gross margin. It can be concluded that the higher the adoption level of DFS, the bigger the impact on profitability. Respondents in the survey mentioned that low adoption level of DFS is caused by digital inequalities, such as the lack of information, training and advice on the use of DFS, access to financial services, lack of financial resources, and the adoption of technical components/internet infrastructure. The most feasible way to improve the profitability of agriculture enterprises is to **familiarize the farmers with DFS through education and training**, as well as **expanding the internet infrastructure to be accessible in rural areas.**

5. Promoting the benefits of digital transformation is one of the digital challenges mentioned by Novak et al. (2018) regarding the digital challenges in Central and Eastern Europe. Hungary's method of using agriculture enterprises to promote training for farmers could be helpful in the case of Indonesia, as agriculture enterprises still have a major role

in the agriculture sector. The 'secret' of this success is that the majority of the farmers are assisted or fully served by the state village agents' network and the private advisors, i.e. agriculture enterprises. The method used in Hungary could be applied to Indonesia by enhancing the role of **agriculture enterprises as a link between DFS and the smallholder/family farmers** to introduce and apply digital technologies.

7. OWN PUBLICATIONS

Widjojo, R. (2020). The Development of Digital Payment Systems in Indonesia: A Review of Go-Pay and OVO e-wallets. ECONOMIC ALTERNATIVES 26 : 3 pp. 384-395.

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Widjojo, R., and Raharjo, I.A. (2018). Rain Barrel Project: Rainwater Harvesting for Sustainable Water Supply in Urban Households Hannover, Germany: Social Science Research Network (SSRN), 7 p.

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Widjojo, R. (2018). A Comparison of the Cooperative Structure in Indonesia and Hungary. GAZDASÁG ÉS TÁRSADALOM 10 : 1 pp. 72-89. , 18 p.

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