An Analysis of Success Factors for German Farmstead Dairies

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Abstract

Farmstead dairies are a small but growing segment in the German dairy market, but there is little information about them. They produce and process milk from their own farm or additionally from a small number of farms from the surrounding area and market it under their own brands. Thus, farmstead dairies offer an alternative for milk producers who wish to generate added value for their milk. Although developing a farmstead dairy with marketing takes time and money and involves some risk, it offers dairy farms an opportunity to be less dependent on outside dairies, to stabilise or increase their income, and to spread their risk. Yet, only limited knowledge is available regarding success factors and their effect on the success of farmstead dairies. The present study addresses this research gap by conducting an online survey of farmstead dairies in Germany to analyse the influence of various internal and external factors on the success of this type of dairy. The results revealed that organic production, a larger processing volume and a product portfolio comprising both Yellow Line and White Line products have a positive effect on success. Furthermore, good cooperation between farmstead dairies and their veterinarians located in a region with a relatively prosperous population and a high population density contributes to the success of farmstead dairies. In addition, the results showed that increased demand during the COVID-19 pandemic has had a positive impact on their success. The results show that there are several starting points for farmstead dairy managers to positively influence the success of their businesses. At the same time, however, there are also a number of factors over which they have no influence.

Keywords

local food supply chains; farmstead dairy; success factors; short food supply chains; dairy sector

1 Introduction

In the past decade, European milk producers have increasingly faced volatile milk prices, with additional market uncertainty provided by the end of the European milk quota in 2015. A large proportion of European raw milk production (32% in 2020 (EUROPEAN COMMISSION, 2020)) is currently exported to global markets, leaving domestic milk price formation dependent on world market prices for dairy commodities. In addition, the public has increasingly been voicing concerns about the dairy sector in recent years, with "factory farming", animal welfare and the growing intensification of agricultural production in general involving social, environmental and economic costs. As a result of the globalization of food supply chains and repeated food scandals, consumers are challenging food production practices and demanding greater transparency in the supply chain (HEMPEL and HAMM, 2016; WU et al., 2021).

Against this backdrop, an increasing number of dairy farmers are seeking to develop alternative marketing strategies for their milk and establishing farmstead dairies (FDs). To identify what is special about German FDs, it is important to have an understanding of the fundamental differences between FDs and normal dairies. In normal dairies, raw milk is produced on a large number of dairy farms in large parts of Germany (and in some cases also from abroad), collected by milk collection trucks and transported long distances to the dairy. The number of milk producers in normal dairies varies from about 50 to more than 5,000. These dairies process the raw milk into different dairy products for export (e.g., milk powder or butter) or consumers (e.g., drinking milk or yogurt) and often produce a number of different brands (private labels and manufacturer brands). The biggest dairy in Germany, *DMK Deutsches Milchkontor GmbH*, for example, processes around 6.3 billion kilograms of milk a year, which it receives from around 5,200 milk producers (DMK, 2022).

In contrast, the FDs assessed in the present paper represent a special form of dairy. Mostly, it is a single farm with dairy cows that has a FD to process its own milk and market it under its own brand, but it can also be a FD additionally supplied by a very small number of other local milk producers. The processing volume of the FDs in this study ranged from 3,000 kilograms to 2.4 million kilograms of milk for 2020. These FDs are mostly family businesses that have a small number

DOI: 10.30430/gjae.2023.0285

of employees, and they develop micro-milk brands (farmstead dairy brands) with an individual profile that makes reference to the farm's regional location, family or FD.

FDs have several options for making products from raw milk and also for marketing them. For example, the possibilities range from milk for drinking, yogurt, cheese and cream to (regional) specialties. In contrast to large dairies, where almost all production steps are automated, much is done by hand in FDs. Various machines are still needed for different products and in some cases a large number of staff as well. In the selection of distribution channels, the products' shelf life is an important aspect since it differs from product to product. For example, fresh milk has a shelf life of just a few days, while it is several weeks for hard cheese. FDs have also many options available to them in product distribution. They can use direct distribution channels and sell their products directly to the consumer, e.g., in their own farm shop, at a weekly market or supplying private households, or they can use intermediaries to market their products through food retailers, wholesalers or other farm shops.

FDs thus have a range of opportunities to process and market milk from their own farms or additionally from a small number of farms from the surrounding area, thereby generating greater added value for their own business, potentially higher value added from their milk production and less volatile revenues. On-farm processing of raw milk is currently evolving as an important strategy for farmers and offers the opportunity to take advantage of the increasing demand for regional food and short supply chains (FELDMANN and HAMM, 2015). However, there are also risks associated with running a FD, as the market for regional milk from FDs is a niche market and establishing a FD is time-consuming and costly (KNUCK, 2020). Furthermore, the FD managers bear the risk for the entire value chain and not only for milk production. Therefore, it is important for FD managers to appreciate how various factors affect the success of their dairies as only successful FDs will be able to stay in the market in the long term and contribute to the dairy farm income.

Literature on success factors for FDs is currently limited. To our knowledge, there exists only one study that focuses on the factors influencing the success of FDs in Germany using a qualitative approach (KNUCK, 2020). The qualitative study of KNUCK (2020) shows that there are internal and external factors, as well as milk characteristics, that influence the success of FDs. The quantitative influence of various dairy-specific and other factors is as yet unclear and will be analysed in this paper to close this gap in the literature. The research question of this paper is therefore:

Which internal and external factors influence the success of farmstead dairies and to what extent?

Success was measured in this study using a success index. This method is based on the self-perceived degree to which various set goals have been achieved (FRITZ, 1995; EVANSCHITZKY, 2003). Thus, the approach takes into account the fact that companies also aim to achieve other goals over and above financial ones.

As there is no official definition of FDs, this study developed its own. The criterion for selecting a dairy as a FD was the number of dairy farmers supplying or managing the dairy. This could be single farmers operating dairy processing facilities and process the milk from their own farms or additionally from a small number of farms in the local area and market it under their own brands.

This paper is the first to analyse the success factors of German FDs using a subjective success index. In addition, it provides previously unknown insights into the numbers and characteristics of FDs in Germany and can thus be used for further research and policy work. Data for this study were collected using an online survey with responses from 113 FDs. We used factor analyses and multiple regression to analyse the influence of the success factors on the economic and personal success of FDs, which is measured using the subjective success index.

This paper has been divided into six parts and is organised as follows: a brief review of the related literature on farmstead dairies and success factors is provided in the next section, Section 3 describes the method, Section 4 presents the results, Section 5 discusses the results and finally Section 6 summarises and concludes the study.

2 Literature Review

Success factor research is based on the theory that there are a few factors that have a substantial influence on the success of businesses (LEIDECKER and BRUNO, 1984; ROCKART, 1979). Success factors can be divided into internal and external factors (GRIMM, 1983). The internal factors include factors that involve the business itself, such as the managers or their fami-

lies. The external factors, on the other hand, include factors that are given by the environment, such as the location.

Due to major differences between 'normal' dairies and FDs, research results on success factors in the dairy industry (WINKELMANN, 2004) can only be transferred to FDs to a limited extent. The literature contains a wealth of studies that explore success factors in agriculture. These have often analysed farms that produce primary products (DAUTZENBERG and PETERSEN, 2005; SCHAPER et al., 2011) or farms with direct marketing (WILLE et al., 2018) or short food supply chains (SELLITTO et al., 2018). There have also been a few studies on (large) dairies in Germany (WINKELMANN, 2004; ZIESENIß, 2014). However, due to the complexity of a FD and the specifics of milk as a raw material, results from other studies can only be transferred to the present research area in a limited way. In the following, study results on success factors of FDs as well as regional marketing projects and farms with direct marketing are presented.

The results of the qualitative study of KNUCK (2020) about success factors of FDs shows that the FD's internal success factors include the FD managers and their managerial skills, financial knowledge in the areas of finance, and expertise in production and marketing. A key person is not only important for FDs, but for all farms with direct marketing or regional projects, as studies by PÖCHTRAGER et al. (2003) or KULLMANN (2007) show. Certain personality characteristics support the likelihood of success, such as joined-up thinking and staying power (BESCH and HAUSLADEN, 1999), motivation, interpersonal skills, interest in customers and a willingness to take risks (KIRNER et al., 2018). Cohesion in farming families represents another success factor, both on FDs (KNUCK, 2020) and other farms with diversification (KIRNER et al., 2018). The support of family members and farm employees in direct marketing operations is important for efficient consumer relationship management and high customer satisfaction (LÜLFS-BADEN et al., 2008). Another important factor is the direct relationship between producers and consumers (SELLITTO et al., 2018). In addition, many studies emphasise the importance of marketing, raising the profile of such farms and their advertising strategy, as well as the quality and image of their products (e.g., DAUTZENBERG and PETERSEN, 2005; PÖCHTRAGER et al., 2003). The study of KNUCK (2020) shows another success factor, namely the working time of the dairy farm managers, because keeping dairy cows is very time-intensive, so managers often do not have time for other parts of the business, which has a negative impact on FDs' success (KNUCK, 2020).

There are also external factors that influence success. The study of KNUCK (2020) analyses the location, the veterinary office and the staff as external success factors of FDs (KNUCK, 2020). Motivated and qualified employees are also analysed by KULLMANN (2004) as a success factor, while WILLE et al. (2018) confirms the positive impact of a good location in their analysis. Furthermore, the region and the attitude of local people towards direct or regional marketing play an important role. Another external factor is the advice given by external institutions (BESCH and HAUSLADEN, 1999). Veterinary offices are the main focus in relation to FDs as they supervise and inspect FDs and determine whether they comply with all the regulations and are allowed to market their products. The high complexity of legal hygiene regulations poses challenges for direct marketers due to the increased workload, bureaucracy and costs involved (WILLE et al., 2018).

3 Method

For data collection, an online survey with FDs was conducted. Given the absence of data on FDs in Germany, we identified the total number of FDs in the country in two ways. First, a list of all dairies with EU approval was obtained from the Federal Office of Consumer Protection and Food Safety (BVL, 2021). The issue with this, however, is that not all FDs need EU approval, thus not all FDs will be on the list. Therefore, secondly, internet research was undertaken using the Google search engine to search for various terms such as 'Hofmolkerei' (farmstead dairy) and 'Hofmeierei' ('Meierei' is a north German word for dairy). Following extensive online research and evaluation of the list, 443 FDs in Germany were identified.

We contacted all 443 identified FDs twice between March 16, 2021 and April 30, 2021 and informed them about the survey using the e-mail addresses found on the FDs' websites. In addition, two farmstead dairy associations sent newsletters to their members, who were also included in the database, to publicise the survey. The cover letter stated that the questionnaire was addressed to FD managers. By the end of the survey period, 261 FDs had clicked on the link to the survey and, of these, 117 FDs had responded

to the online survey by the end of the survey period, corresponding to a completion rate of 44.83%. One of these 117 FDs did not process cow's milk and was removed from the dataset, while another FD indicated that it was supplied by 75 milk producers, therefore, it did not meet this study's definition of a FD and was also removed. Information from two FDs was implausible, therefore, they were also deleted. Consequently, 113 records from FDs could be included in the analysis, which represents 25.5% of all FDs that could be identified and contacted in Germany. In 80 cases, the questionnaire was completed by the manager, in 18 cases by the spouse, in six cases by the farm successor and in nine cases by a person employed in the FD.

The survey included statements about the FD's internal and external success factors to be answered using a seven-point Likert scale which ranges from 1 "*Totally disagree*" to 7 "*Totally agree*". The items were based on statements made by experts in a previous study (KNUCK, 2020) and focused on the internal success factors of family, marketing and planning. The family items related to the support provided by the FD manager's family. The items connected to marketing included the product portfolio, advertising measures and price calculations, as well as regular customers because they are the result of successful customer-oriented marketing. Further statements concerned joint planning by the FD and veterinary office as this could be analysed as an important aspect in the preliminary study (KNUCK, 2020). In addition, the questionnaire contained additional questions about the FD's internal success factors (year of opening, manager's time in position, organic or conventional production, number of milk suppliers, processing volume, product portfolio, prices and sales channels).

Other items focused on the external success factors of veterinary and region. The veterinary items included individual cooperation between veterinarians and FDs, as well as veterinarians' perceived practical orientation. The regional items referred to people living in the FD's local area, their attitude to regional products, their purchasing power and population density. Due to the COVID-19 pandemic impacting the entire national and international economy from 2020 onwards, additional items focusing on the COVID-19 pandemic were formulated.

We performed two exploratory factor analyses on the data from the online survey using IBM SPSS Statistics 25. For each of the two factor analyses, we used a principal component analysis with oblique rotation due to the correlation of the factors (HAIR et al., 2019). One factor analysis was performed for external success factors and the other for internal success factors. Both, Bartlett's test ($p < .001$) and the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO = 0.740 and 0.642) indicated that the items were suitable for factor analysis. Consistent with KAISER and RICE (1974), only items that had measure of sampling adequacy (MSA) values greater than 0.5 were used for analysis. The Kaiser criterion was used to determine the number of factors based on their eigenvalue (> 1).

For the subjective success index the questionnaire contained questions about twelve individual FD's aims and self-perceived degree of achievement of these aims. Common indicators to measure the success of companies such as profit, return on investment or growth are based on accounting data (COLLINS-DODD et al., 2005). Unlike other studies about success factor research based on accounting data (e.g., DAUTZENBERG and Petersen, 2005), this kind of data for FDs are not available and could not be retrieved via the online survey for time constraints and cognitive burden. Therefore, we rely on an approach developed by FRITZ (1995) and EVANSCHITZKY (2003) to develop a success index (1). According to FRITZ (1995), if success is defined as the degree of self-perceived achievement of goals, the first step is to determine what an individual FD's goals are. It is likely that FDs are managed by the farm manager or a family member. In contrast to a manager who has been employed for a company and focuses mainly on financial goals, the goals of the farm manager and his or her family can include many other aspects over and above these (ISELBORN, 2016). Since success can also be measured by other variables, the questionnaire asked about other potential goals in addition to the FD's financial variables of sales growth, profit and a secure liquidity position. These were: independence from an external dairy, self-actualisation in the job (JAYAWARNA et al., 2013), job enjoyment, customer satisfaction (DROSSE, 1995), risk diversification and preservation of jobs in the region. The importance of individual goals was measured using a six-point Likert scale ranging from 1 "*no relevance*" to 6 "*very high relevance*". After the importance of their goals, questions were also asked about the degree of achievement of the goals in order to be able to form the subjective success index (1). Degree of achievement was also measured by using a six-point Likert scale ranging from 1 "*not at all (0%)*" to 6 "*beyond*

the goal (>100%)". Thus, we define the success index of farmstead dairy *i* as

$$SI^i = \sum_{j=1}^{n} \frac{I_j^i \times A_j^i}{I_{j,max} \times A_{j,max}}, \quad (1)$$

where I_j^i denotes the importance of goal *j* for farmstead dairy *i*, and A_j^i denotes the degree of achievement of goal *j* for farmstead dairy *i*. Further $I_{j,max}$ denotes the maximal value of importance of goal *j* and $A_{j,max}$ denotes the maximal degree of achievement of the goal *j*.

Since the number *n* of goals is 12 and both $I_{j,max}$ and $A_{j,max}$ have a constant value of 6, the success index ranges from the minimum of 1/3 to the maximum of 12.

In order to analyse the influence of the success factors onto the success index *SI* of FDs, we model the success index as affine function of the vector of success factors $\boldsymbol{x} = (x_1, \ldots, x_n)$ through

$$SI(\boldsymbol{x}) = sc_o + \sum_{j=1}^{n} sc_j x_j, \quad (2)$$

where $\boldsymbol{sc} = (sc_0, \ldots, sc_n)$ is the vector of success coefficients, *n* is the number of success factors and *j* counts over the success factors.

We compute these success coefficients with the statistical technique of multiple linear regression analysis (MLRA) based on our found data. Hence, in the sense of MLRA the success index $SI(\boldsymbol{x})$ is the variable of interest and the success coefficients sc_j are the coefficients of interest. Further, in this sense the internal and external success factors x_j are the independent variables. Internal success factors include on-farm variables and factors describing characteristics of the FDs and characteristics of the FD management and their families (e.g. organic production or family staff). External success factors include e.g. the veterinarian.

To determine the success coefficients sc_j with MLRA we make the approach

$$SI^i = SI(\boldsymbol{x}^i) + \varepsilon^i = sc_o + \sum_{j=1}^{n} sc_j x_j^i + \varepsilon^i, \quad (3)$$

where SI^i denotes the success index, $\boldsymbol{x}^i$ the vector of success factors and ε^i denotes the error term for the farmstead dairy *i*. Then we use the ordinary least squares (OLS) method to minimize the error $\boldsymbol{\varepsilon} = (\varepsilon^0, \ldots, \varepsilon^m)$, from which we gain the success coefficients sc_j. The results are given in Section 4.

This two-step approach of explanatory factor analysis and MLRA was chosen due to the small sample size. Other studies often use structural equation modelling to analyse success factors. However, the number of 113 observations in this study was below the minimum sample size of 150 recommended by MUTHÉN and MUTHÉN (2002) for an analysis of this kind.

As there are no official data on the number of FDs in Germany, the population of these dairies is unknown. Therefore, the sample is a non-random convenience sample and may be biased against the (unknown) total population. Firstly, some FDs may have been overlooked in the creation of the database. Thus, it cannot be ruled out that certain FDs, for example smaller ones, had a lower probability of being included in the sample than others. Second, there is the self-selection bias because the FDs could decide for themselves whether or not to participate in the online survey. Thus, the results of the present analyses are valid for the sample but not necessarily for the (unknown) population of FDs.

4 Results

The online research led to the identification of a total of 443 FDs in Germany. Table 1 shows that almost all German federal states have FDs. Berlin is the only federal state without an FD, probably because it is a city state consisting only of the city of Berlin.

Table 1 shows the FDs that participated in the survey and how they correspond to the number of dairy farms in Germany. The table shows that there are clear differences within Germany. Most FDs are located in southern Germany, with 30.02% in Bavaria and 17.15% in Baden-Württemberg. However, there are also FDs in western and northern Germany (22.58% and 20.55%), but very few FDs in eastern Germany (9.7%). The varying distribution of FDs matches the heterogeneous distribution of dairy farms in Germany, with 56.51% of dairy farms in southern Germany but just 4.87% in the eastern part of the country. The table also shows the share of dairy farms with a FD, which varies between 0.65% in southern Germany and 1.54% in the east. For Germany as a whole, the share is 0.77%.

Table 1. Overview of farmstead dairies and dairy farms in Germany in 2020 and the survey participants

	All identified farmstead dairies (N = 443)		Participating farmstead dairies (N = 113)		Dairy farms in Germany[1]		Share of dairy farms with a farmstead dairy
	abs.	%	abs.	%	abs.	%	%
North Germany							
Lower Saxony	48	10.84	10	8.85	8,498	14.83	0.56
Schleswig-Holstein	33	7.45	6	5.31	3,591	6.26	0.92
Mecklenburg Western Pomerania	7	1.58	3	2.65	683	1.19	1.02
Bremen + Hamburg	3	0.68	2	1.76	60	0.10	5.00
Total	91	20.55	21	18.57	12,832	22.39	0.71
South Germany							
Bavaria	133	30.02	25	22.12	26,345	45.96	0.50
Baden-Württemberg	76	17.15	19	16.81	6,046	10.55	1.26
Total	209	47.17	44	38.93	32,391	56.51	0.65
West Germany							
Northrhine-Westphalia	43	9.71	13	11.5	5,166	9.01	0.83
Hesse	39	8.8	8	7.08	2,408	4.20	1.62
Rhineland Palatinate	15	3.39	5	4.42	1,550	2.70	0.97
Saarland	3	0.68	1	0.88	184	0.32	1.63
Total	100	22.58	27	23.88	9,308	16.24	1.07
East Germany							
Saxony	18	4.06	8	7.08	1,112	1.94	1.62
Brandenburg	11	2.48	6	5.31	598	1.04	1.84
Saxony-Anhalt	8	1.81	2	1.77	553	0.96	1.45
Thuringia	6	1.35	5	4.42	522	0.91	1.15
Berlin	0	0	0	0	6	0.01	0.00
Total	43	9.7	21	18.58	2,791	4.87	1.54
Total Germany	443	100	113	100	57,322	100	0.77

Source: Author's calculations based on own data and [1]Destatis (2021)

As can be seen in Table 1, FDs in all federal states participated in the online survey. The relative proportion of survey participants located in northern and western Germany matched the relative distribution for Germany as a whole. However, participating FDs in eastern Germany were slightly overrepresented at 18.58% compared with 9.7% for all FDs in eastern Germany, while the percentage of participating FDs in southern Germany was somewhat underrepresented at 38.93% compared with 47.17% for all FDs in southern Germany.

The vast majority of FDs purchased their milk from one dairy farm (85.84%), but a small number of FDs in the dataset were supplied by between two and 12 milk producers. Table 2 shows the structure of milk input deliveries for FDs.

The FDs in the survey were very diverse. Some had been operating since before 1900 and had already been managed by different people, while others only commenced their operations in the past year. Consequently, the average time that FDs had been operating in the market was 19.1 years, with a high standard deviation of 18.8 years (Table 3). The average number of years the FDs had been managed by the current management was 11.6 years (std. dev.: 8.7 years). The volume of raw milk processed in one FD in 2020 ranged from 3,000 kg to 2.4 million kg, with an average volume of 274,640 kg (std. dev.: 415,547 kg). For

Table 2. Number of milk producers behind the farmstead dairies

Number of dairy farms supplying the farmstead dairies	Frequency	%
1	97	85.84
2	9	7.96
3	1	0.88
4	3	2.65
8	1	0.88
10	1	0.88
12	1	0.88

Source: Author's calculations based on own data

Table 3. Descriptive details about farmstead dairies

	Mean	Std. Dev.	Min	Max	n
Years on the market (years)	19.1	18.8	1	131	113
Time managed by the same person (years)	11.6	8.7	1	32	113
Processing volume 2020 (kg)	274,640	415,547	3,000	2,400,000	113
Share of processed milk 2020* (%)	54.43	35.65	2.50	100	82**
Number of product categories (abs. number)	6.3	3.1	1	14	113
Number of distribution channels (abs. number)	3.9	1.7	1	9	113

*What percentage of the milk produced by the corresponding dairy farm is processed by the farmstead dairy? **The percentage can only be given for FDs that receive their milk exclusively from one farm and have reported the quantities in the questionnaire.
Source: Author's calculations based on own data

FDs that obtain their milk from just one dairy farm, the percentage they processed of that dairy farm's total milk production ranged from 2.5% to 100%. This means that there are FDs that process all the milk produced by a dairy farm (share of processed milk = 100%) and others that process only some of that milk, with the remainder of the raw milk supplied to an external dairy.

Table 3 also shows that FDs produce an average of 6.3 different product categories (e.g., raw milk, yogurt, semi-hard cheese). Some FDs only offer products from one category, while others produce products in up to 14 categories. In the dairy sector, dairy products are generally divided into White Line and Yellow Line products. White Line includes products such as drinking milk, yogurt and cream, while Yellow Line includes cheese. All FDs produce White Line products, but 92 FDs (80%) have a broader product range and also produce Yellow Line products. There are also differences in the number of distribution channels (e.g., farm shop, food retailer or delivery to private households). Some FDs use one channel to market their products, others up to 9. The average number is 3.9. The share of organic and conventional FDs in the dataset is 51% and 49% respectively.

Results of the Factor Analysis

Nine factors were identified by conducting two explanatory factor analyses. Table 4 and Table 5 show each item for the factors and their factor loadings. The reliability of a factor is measured using Cronbach's alpha and provides information about the factor's internal consistency. Based on HAIR et al. (2019), Cronbach's alpha is consistent and reliable for many factors ($\alpha > 0.6$) except factors 3 and 4. The five factors from the first analysis of internal success factors explained 66.91% of the variance and the four factors from the second factor analysis of the external success factors explained 64.9% of the variance.

Table 4 shows each statement of the five internal factors according to their factor loadings. Factor 1 is interpreted as '*inner support*' and describes the support of people who are close to the FD managers. These include not only family members, but regular customers too. Factor 2 is the '*products and assortment*' factor, which relates to the product portfolio and its adaptation or change over time. Factor 3, '*price calculation*', reveals the basis on which the FD calculates its prices. Factor 4 '*advertising*' describes the use of social media as promotion platforms and the FD's promotion of the regional origin of its products. As the Cronbach alphas were below 0.6, factors 3 and 4 were not used for further analyses. Factor 5, '*planning*', provided information on the extent to which the FD was planned jointly with the veterinary office.

The first external factor (Factor 6) '*veterinarian*' describes the cooperation between the FDs and the veterinarian, how legal requirements can be implemented in practice and what the veterinarian's perceived attitude is to FDs (Table 5). Factor 7 is interpreted as '*positive effects of the COVID-19 pandemic*' and includes positive effects of the pandemic, such as the acquisition of new customers, increased demand for dairy products and support from customers. Factor 8 is interpreted as '*population in the region*' and describes the available purchasing power, population density and perceived attitude of local people to direct marketing. In addition, the factor includes the aspect of the tradition of direct marketing in the region. Factor 9 can be labelled as '*operational changes due to the COVID-19 pandemic*'. Owing to the pandemic, FDs were often faced with changing demand from single customer groups (e.g. direct delivery due to quarantine), distribution channels (e.g., due to closure of the food service sector, hotels or schools) or due to hygiene and distancing rules, and had to react accordingly. Factor 9 describes the adap-

Table 4. Factor loadings of the internal success factors

Statements provided in the questionnaire	Factor loadings				
	Factor 1	**Factor 2**	**Factor 3**	**Factor 4**	**Factor 5**
	'inner support' α = 0.767	'products and assortment' α = 0.629	'price calculation' α = 0.410	'advertising' α = 0.429	'planning' α = 0.625
As a family, we support each other.	0.861	-0.031	0.034	0.297	-0.094
The whole family is behind the farmstead dairy.	0.858	0.009	-0.061	0.246	-0.079
We receive important feedback from our customers.	0.682	0.052	0.258	-0.291	0.079
We have many loyal regular customers.	0.565	0.031	-0.100	-0.297	0.209
We are inspired to create new products by what our customers say they want.	-0.039	0.805	0.067	-0.024	0.084
In order to remain interesting for our customers, we change the products in our range.	-0.033	0.803	-0.114	0.263	-0.008
We remove products from our range for which demand is low.	0.084	0.639	-0.010	-0.196	-0.151
Our prices are based on the prices of products from other suppliers.	0.054	-0.183	0.861	-0.034	-0.112
We calculate our sales prices on the basis of our costs.	-0.039	0.233	0.658	0.196	0.220
We regularly use social media (e.g., Facebook or Instagram) to inform people about our farmstead dairy, our products or agriculture in general.	0.036	0.063	0.152	0.788	-0.017
We specifically promote the regional origin of our products.	0.284	-0.095	-0.186	0.527	0.232
We planned the farmstead dairy with our district veterinary office.	-0.138	-0.093	-0.018	0.020	0.938
Right at the beginning when we were planning the farmstead dairy, we informed the veterinary office of our plans.	0.399	0.084	0.118	0.008	0.600

α = Cronbach alpha; Bartlett's test = 0.000; Kaiser-Meyer-Olkin (KMO) = 0.642; measure of sampling adequacy (MSA) lowest/highest = 0.506/0.745. Proportion of overall variance explained: 66.91%.
Source: Author's calculations based on own data

tations to the new situation and potential difficulties associated with it.

Results of the Multiple Regression Model

Table 6 presents the results obtained from the analysis of the multiple linear regression model. Since this is not a random sample, the results apply to the present sample but not necessarily to the (unknown) population of FDs. The adjusted R-squared is 0.4781, implying that 47.8% of the variance of the dependent variable can be explained by the model. The model includes all factors from the two previous factor analyses whose Cronbach's alpha is greater than 0.6. Factor 3 and 4 have a Cronbach's alpha below 0.6, so their internal consistency is not sufficient enough for further analysis. Therefore, they were not included in the model.

The top part of the table shows internal variables related to the FDs themselves, first to the FD characteristics, second to the FD management and the families of the managers. The lower part shows external variables related to aspects outside the FD.

The results of the internal variables related to the FDs themselves show that FDs in the sample which process organic milk into dairy products have a success index 0.706 higher than conventional ones ($p < 0.022$). The time a FD is on the market, in contrast, has a negative impact on its success. The coefficient for 'years on the market' is -0.027 ($p < 0.002$), which means that the success index decreases by 0.027 with each year that the FD is on the market. This indicates that as the age of the FD increases, success decreases. Furthermore, the success index increases by 0.002 with each additional ton of milk processed by the FD ($p < 0.001$). This coefficient is very small and shows that a larger amount of processing has only a small effect on the success index.

The regression coefficient for the number of distribution channels is 0.047 ($p < 0.56$) and for the product categories -0.028 ($p < 0.57$). The coefficient

Table 5. Factor loadings of the external success factors

Statements provided in the questionnaire	Factor loadings			
	Factor 6	**Factor 7**	**Factor 8**	**Factor 9**
	'veterinarian' α=0.926	'positive effects of the COVID-19 pandemic' α=0.829	'population in the region' α=0.739	'operational changes due to the COVID-19 pandemic' α=0.641
The cooperation with the responsible district veterinarian regarding the farm dairy is going very well.	0.911	0.025	0.055	-0.015
There has been good contact between the responsible veterinarian and us for years with regard to the farm dairies.	0.911	0.069	-0.003	0.066
Our veterinarian also takes into account that the legal requirements can be implemented in practice.	0.877	-0.026	-0.003	-0.058
Our veterinarian has a positive attitude towards farms with direct marketing.	0.859	0.022	-0.094	0.088
Our veterinarian offers solutions if problems occur.	0.834	0.011	0.133	-0.052
Demand for our dairy products has risen sharply.	0.114	0.863	-0.103	-0.156
We have gained many new customers.	0.091	0.830	0.013	0.093
During the COVID 19 pandemic, we received a lot of encouragement from our customers.	0.008	0.718	0.033	0.139
The farm dairy proved to be a safe mainstay during the pandemic.	0.029	0.650	0.001	-0.239
Sales of our dairy products have decreased.	-0.098	-0.631	0.021	-0.467
Sales through food retailers have increased.	-0.099	0.581	0.046	0.322
The purchasing power of the population in our region is high.	0.041	-0.082	0.905	-0.059
Many people live in our region, it is densely populated.	0.060	-0.021	0.812	0.109
Direct marketing has a long tradition in our region.	0.020	-0.058	0.716	0.056
The population in our region has a positive attitude towards regional products.	-0.053	0.221	0.500	-0.173
Due to the COVID 19 pandemic, we had to adjust our sales channels.	0.053	-0.167	-0.009	0.796
Due to the COVID 19 pandemic, we had to adjust our product range.	0.119	0.053	-0.215	0.739
We have had difficulties adjusting our operations in accordance with legally mandated protective measures to contain the pandemic.	0.101	-0.108	-0.180	-0.662

α = Cronbach alpha; Bartlett's test = 0.000; Kaiser-Meyer-Olkin (KMO) = 0.740; measure of sampling adequacy (MSA) lowest/highest = 0.552/0.856; proportion of overall variance explained: 64.9%.
Source: Author's calculations based on own data

of the variable 'Yellow Line' is 0.974. This indicates that producing both White Line products, such as milk and yogurt, and Yellow Line products is related to an increase in the success index by 0.974 ($p < 0.006$). Furthermore, the coefficient for the variable of external staff indicates that employing external staff is related to a 0.738 increase in the success index ($p < 0.08$).

For the internal variables relating to the FD management and the family, the coefficient for 'duration of management' is positive (0.04, $p < 0.01$). For each year that the managers manage their dairies, the success index increases by 0.04. Another result is the coefficient of the factor variable 'F5_planning', which is -0.409 at the $p < 0.01$ level. This means that the success index of a FD is lower if they inform the veterinary office at the start of FD planning and plan it jointly. Psychological support also has an effect on success. The results show a coefficient of 0.258 for the variable 'F1_inner_support' ($p < 0.07$). FD managers who are supported by people close to them, such as family members but also regular customers, have a higher success index of 0.258. In contrast, the factor variable 'F2_products' has a negative impact on the

Table 6. Influence of internal and external variables on the success of farmstead dairies: results of a multiple linear regression model

Variables	Regression coefficients	P > |t|	t value
Internal variables			
FD characteristics			
Organic (dummy variable)	0.706	0.021	2.34
Years on the market (years)	-0.027	0.001	-3.42
Milk volume (t)	0.002	0.000	5.63
Yellow line (dummy variable)	0.974	0.005	2.91
Product categories (quantity)	-0.028	0.563	-0.58
Distribution channel (quantity)	0.047	0.555	0.59
External staff (dummy variable)	0.738	0.073	1.81
FD management and family			
Duration of management (years)	0.040	0.008	2.73
F5_planning	-0.409	0.003	-3.01
F2_products	-0.081	0.548	-0.60
Family staff (dummy variable)	0.423	0.186	1.33
F1_inner_support	0.258	0.064	1.87
External variables			
F6_veterinarian	0.411	0.004	2.97
F7_covid_positive	0.460	0.001	3.41
F9_covid_change	0.054	0.698	0.39
F8_region	0.249	0.049	2.00
Constant	3.959	0.000	7.50

Number of observations = 113; F (16, 96) = 7.41 (Prob > F = 0.0000), Adj. R-squared = 0.4781.
Source: Authors' calculations based on own data

success index (-0,081, $p < 0.55$), while the coefficient of the variable 'family staff' is related to a higher success index (0.423, $p < 0.19$).

The results of the external variables show a positive coefficient of the veterinarian factor variable (F6_veterinarian). The coefficient for F6_veterinarian indicates that the veterinarian and ongoing cooperation between the veterinarian and the FD during operation related to an increase in success index by 0.411 ($p < 0.01$). Another influence is shown by the coefficient of the variable relating the positive effects of the COVID-19 pandemic (F7_covid_positive). FDs that benefited from the positive effects of the pandemic, such as attracting new customers or increased sales, have a higher success index (0.460, $p < 0.01$). In comparison, the other pandemic factor variable 'F9_covid_change' shows a lower positive impact of 0.054 on the success index ($p < 0.7$). The coefficient of the factor variable 'F8_region' is positive (0.249, $p < 0.05$). This variable focuses in particular on the population in the region and indicates the influence of the region on the success index. A location in a region where there is a long tradition of direct marketing, with strong purchasing power and a greater population density is related to an increase of the success index by 0.249. Since all external variables are based on a seven-point Likert scale, the coefficients can be compared with each other. The comparison shows that the positive impact of the COVID-19 pandemic had the largest impact on the success index (0.411), while the factor variable 'F9_covid_change' has the smallest impact (0.054).

5 Discussion

The results of the multiple regression analysis show that different internal and external variables influence the success of farmstead dairies (FDs). In the case of FD characteristics, the composition of the product portfolio in particular shows a major influence on success, as does the combination of Yellow Line and White Line products. The production of both, Yellow Line and White Line products leads to an increase in the success index of 0.974. Since the scale of the success index ranges from 1/3 to a maximum of 12.00, an increase of 0.974 ($p < 0.01$) represents an economically significant result. This result reflects those of PEREIRA et al. (2018) who found that a limited product portfolio can negatively impact the success of

projects that market milk (PEREIRA et al., 2018). However, the results show that the number of product categories has only a small influence on success (-0.028, $p < 0.57$) and it hardly matters, whether FDs regularly change or adjust their portfolio (-0.081, $p < 0.55$). These results highlight that the composition of the product portfolio is more important than the absolute number of product categories. This information is important when FD managers are thinking about changing their product portfolio to make their FDs more successful. Furthermore, the number of distribution channels has only a minor influence (0.047, $p < 0.56$). These results suggest that there is a set of different varieties of product and marketing combinations that can be successful, ranging from FDs that specialise mainly in the production of cheese and sell it at the weekly market to those that offer a wide variety of products and use different direct and indirect sales channels for marketing. Another explanation could be that the FDs have different goals; not all of them have the goal of maximising their profit or using economies of scale. It is possible that some managers enjoy producing the various products and run their FD more as a passion than a business.

Another important result is the high positive influence of organic production (0.706, $p < 0.03$), which is consistent with that of SELLITTO et al. (2018), who also show its important influence in their study. Although this variable shows a relatively high effect on success, it is not recommended to convert every FD to organic. The conversion of a FD from conventional to organic production is complex and depends on many factors. Each FD must decide individually whether the conversion is right for it. Consistent with literature (e.g., KULLMANN, 2004), this research shows that external staff also have an economically significant positive impact on success (0.738, $p < 0.08$). External staff can relieve FD managers, allowing them to take care of important matters, feel less stressed and be more satisfied. Since many products in FDs are produced by hand, the use of external staff is essential when many different products are produced or large quantities are processed and have to be filled or packed by hand.

Interestingly, the coefficient for years on the market is negative (-0.027, $p < 0.01$), while there is a positive coefficient for duration of management (0.04, $p < 0.01$). Both coefficients are relatively small, with duration of management activity having a slightly stronger effect on success than years on the market. One possible explanation for this might be that the managers' expertise increases the longer they are in charge, enabling them to manage their companies more successfully. This result is in line with other studies analysing the manager's importance (e.g., BESCH and HAUSLADEN, 1999). However, a longer time on the market could have a negative impact because machines have to be replaced or the FD has to be adapted and rebuilt to meet new hygiene regulations. Another problem could be not having sufficient capacity to respond to increasing demand, which has a negative impact on success because no development is possible.

Another interesting result is the small influence of a greater processing volume (0.002, $p < 0.01$). This result shows that processing volume has only a very small impact on success and that smaller FDs can be just as successful as larger ones. Due to the very low impact on success, expansion of processing capacity cannot be recommended for every FD. Often, an increase in processing capacity is associated with costs, as more personnel must be employed or the FD building must be expanded. Each FD should individually evaluate whether a higher processing volume is going to be profitable for them.

The positive influence of family staff and 'inner support' seems plausible because FD managers can rely on their family members and obtain support when they need it. Furthermore, through feedback from their family members and regular customers, they are given important information on how to improve their dairies and products or identify new trends at an early stage. With their constant purchases, regular customers can also help FDs to plan and produce more efficiently. This is particularly relevant for FDs that process products with a short shelf life. Better planning results in smaller losses because less is thrown away and this can therefore have a positive impact on profits and satisfaction. These results reflect those of SELLITTO et al. (2018) who also found that the relationship between the producer and consumer is a success factor in short food supply chains.

Surprisingly, joint planning by the FD manager and the veterinarian office had a negative impact on the success index (-0.409, $p < 0.01$). This finding was unexpected because in Germany it is necessary to inform the veterinarian right at the start of planning because they need to give approval before milk can be processed and marketed. In addition, there are many laws and (hygiene) regulations that need to be followed, which could explain the negative coefficient. The overwhelming regulations and guidelines im-

posed by the veterinary office on FD managers could have a negative impact on satisfaction and individual fulfilment, which reflect part of the success index. In addition, costs that were not anticipated by managers could increase if, for example, special flooring or wall coverings have to be installed and thus reduce their profits.

In contrast to the negative impact of joint planning, the cooperation and practical skills of the veterinarian has a positive influence on the success of FDs (0.411, $p < 0.01$). This finding is important because it shows how dependent the FDs are on veterinarians. This result is consistent with the study of KNUCK (2020). Her study shows that due to the different attitudes and decisions by veterinarians in Germany's different regions, not all FDs have the same competitive opportunities (KNUCK, 2020). Due to the fact that FDs do a lot by hand and use less machinery, they clearly differ from "normal" dairies. In addition, veterinarians often only get to know "normal" dairies during their training, so they have little experience with FDs. In this context, it is important for veterinarians to be trained in dealing with small dairies as well in order to be able to provide practical advice and control.

The research also shows a comparatively high positive influence of the positive impact of the COVID-19 pandemic (0.460, $p < 0.01$), while the impact of the changes caused by the pandemic is low (0.054, $p < 0.7$). One possible explanation is that some FDs took advantage of the increased demand for regional products and therefore benefited from the pandemic. At the same time, although some FDs reported that they had adapted their products and distribution channels, the results show little corresponding impact on success. One possible explanation for this might be that they encountered few difficulties, for example instead of supplying schools, they supplied private households or marketed more through grocery stores. Another finding was the influence of the region and local population (0.249, $p < 0.05$). This is in line with the study of BESCH and HAUSLADEN (1999), who describe local people as an important factor in regional projects. Here, politics could start and promote producers and products from the region in order to positively influence the attitude of the population towards regional products.

A limitation of this research was the subjective success index, as this is based on the subjective assessment of the respondents and not on objective data such as accounting data. Another limitation in connection with the success index is the selection of goals, as some FDs may have other goals that were not taken into account. However, since the results can be interpreted logically and are consistent with existing results on farms with direct marketing and the study on FDs by KNUCK (2020), the subjective success index seems to be a suitable instrument for the present study despite its limitations. It can also be assumed that the results are transferable to other FDs. Of course, further research is needed to confirm the generalizability of the results.

6 Summary and Conclusions

Farmstead dairies (FDs) can be found throughout Germany and differ in their processing volumes, product portfolios and choice of sales channels. Using an online survey with 113 FDs, a multiple regression analysis revealed that internal factors of organic production, a higher processing volume and a product portfolio consisting of White and Yellow Line products have a positive influence on success. It is not necessary to have a broad product category portfolio, use a range of distribution channels or change the portfolio regularly, but it is more important to offer an adjusted mix of Yellow Line and White Line products. In addition, a FD manager with more experience, the use of external staff and the 'inner support' of family members and regular customers all have a positive effect. A negative influence on success is associated with the joint planning of the FD with the veterinarian. But with regard to external factors, the results demonstrate a positive influence of the veterinarians during the ongoing operation phase. In addition, the results show a positive influence of the COVID-19 pandemic, with FDs picking up new customers and demand for their dairy products increasing during this period. Another finding is the positive influence of the region if it has good purchasing power and a high population density.

The results show that there are several internal success factors that can be influenced by the FDs themselves in order to be more successful. FD managers should rethink their product portfolio and expand it to include Yellow Line products, as the results show the importance of having a product portfolio of Yellow and White Line products. The results also highlight the importance of various external factors that cannot be controlled by FDs, such as the behaviour of their veterinarians. However, the finding reported here about veterinarians sheds new light on their impact on

the success of FDs. FDs could be supported by policies that recommend veterinarians to include more practical aspects in the regular advice they give to FDs and their statutory monitoring. FDs can benefit greatly from having veterinarians assisting them with the implementation of laws in practice and ensure legal compliance in the long term.

This study is the first to examine the quantitative influence of success factors in FDs. It thus provides important information for policymakers on how to support regional enterprises and for FD managers on how they can positively influence the success of their FDs. Due to the large differences between FDs, the results cannot be applied equally to all FDs. An individual examination of each FD is essential for optimizing it. Transferability of the results to other farms that process and market their own products is only possible to a limited extent, as the processing and marketing of milk clearly differs from other products such as fruits or vegetables.

However, a need for further research was identified with regard to the impact of various success factors based on accounting data, which are not yet available. In addition, it would be interesting to study the long-term impact of the COVID-19 pandemic to determine whether FDs can benefit from increased interest in FD products in the long term. In order to verify the generalizability of the results, it is essential to determine the population of FDs and to conduct further research.

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