Available online at www.centmapress.org

INTERNATIONAL JOURNAL ON FOOD SYSTEM DYNAMICS

Proceedings in
System Dynamics and Innovation in Food Networks 2016

Acceptance of a Sustainability Standard: Evidence from an Empirical Study of Future-Oriented Dairy Farmers

Luhmann, Henrike; Schaper, Christian and Theuvsen, Ludwig

University of Goettingen, Department of Agricultural Economics and Rural Development,
Platz der Goettinger Sieben 5, D-37073 Goettingen
Contact: henrike.mueller@agr.uni-goettingen.de

ABSTRACT

As a major agricultural subsector, milk production plays an important role in the EU 28. Political decisions such as the abolition of the milk quota system in 2015, highly volatile milk prices and fierce international competition have led to challenges for both farmers and dairies and a need to improve competitiveness. The concept of sustainability in the form of a production standard can be seen as a means for both dairy farmers and dairies to gain competitive advantages and meet stakeholders' demands. Farmers' acceptance of a sustainability standard is an important factor for its successful implementation. Therefore, future-oriented farmers are an important target group for dairies. This study investigates future-oriented dairy farmers' acceptance of a comprehensive sustainability standard and, based on their responses, categorizes farmers into three different clusters: 'halfhearted sustainability proponents', 'highly dedicated sustainability proponents' and 'profit-oriented sustainability refusers'. Further analysis provides insights into the determinants of farmers' acceptance of a sustainability standard. The results of this study provide manifold starting points for deriving managerial implications for dairies and the implementation of sustainability standards.

1. Introduction

Milk production plays an important role in the EU 28. The leading European milk producers are Germany (production volume: 31.3 m tons per year), France (24.4 m tons) and the United Kingdom (13.9 m tons) (Destatis 2015). Political decisions such as the abolition of the milk quota in 2015, highly volatile milk prices and fierce international competition have led to major challenges for both dairy farmers and dairies and demand adjustment measurements from them to stay competitive (Doluschitz 2009). A central position in the current situation of low producer prices is attributed to retailers, who have high bargaining power and are therefore in a position to set the milk price (Hartmann 2001; Dries et al. 2009; Milchtrends.de 2015). From society's point of view, milk production has a relatively positive image and is much better accepted than pork and poultry production. Nevertheless, demands for more animal-friendly milk production with a focus on grazing opportunities for cows and other improvements in animal welfare standards as well as more sustainable feed production are emerging issues in public debates in many European countries (Kühl et al. 2014; Gauly 2015).

Facing these challenges, dairies are currently in search of a long-term strategy to meet society's demands while maintaining or even improving their competitiveness despite the currently low milk price. The concept of a sustainability standard for producers, understood as a commitment to more sustainable milk production, can be seen as a means by which farmers and dairies can gain and sustain competitive advantages (e.g. high milk quality, animal health, persistence of dairy cows) and meet society's demands (e.g. animal welfare, animal ethics, environmentally friendly production) (Porter/Kramer 2006; Flint/Golicic 2009; Heyder/Theuvsen 2012).

DOI 2016: pfsd.2016.1648

In this paper, sustainability is defined with reference to the so-called triple bottom-line approach. This means that companies striving for higher sustainability integrate ecological and social goals in addition to their primary objective of making a profit. These three pillars—economic, ecological and social responsibility—result in long-term sustainable development at the enterprise level (Crane/Matten 2004). The concept of sustainability has also gained growing relevance in the agribusiness sector (Friedrich et al. 2012). Van Calker et al. (2005), Meul et al. (2012) and Lassen et al. (2014) all identify comprehensive sustainability approaches for the dairy industry. These concepts mainly follow the general sustainability approach of the three pillars and also add and animal ethics dimension (van Calker et al. 2005; Meul et al. 2012; Lassen et al. 2014). Schodl et al. (2015) point out animal welfare as an important aspect for sustainability. Despite various attempts to define sustainability concepts for the dairy sector, comprehensive research in this field is still scarce. Most previous studies have focused on individual areas of sustainability in the dairy industry. Studies that focus on the ecological approach address aspects concerning land conservation, reduction of water consumption, energy use or environmental pollution (cf. Refsgaard et al. 1998; van Calker et al. 2004, Meul et al. 2009). The second pillar, namely the economic approach, is generally characterized by reference to financial performance indicators such as net farm income or animal productivity, for instance, milk yield (cf. Santarossa et al. 2004; van Calker et al. 2004; Camarillo et al. 2012). The social approach is the third pillar of sustainability. Van Calker et al. (2005) separate the social dimension into internal social sustainability, such as working conditions, volunteering or work training, and external social sustainability, such as animal welfare, animal health, landscape quality and food safety (cf. Armstrong/Pajor 2001; van Calker et al. 2005, 2007).

Dairies worldwide have put sustainability on their agenda. The dairy industries in the United States (Innovation Center for U.S. Dairy 2015), Australia (The Australian Dairy Industry 2015) and some European countries, such as Ireland (Origin Green 2015), have already introduced initiatives for chain-wide sustainability schemes. Meanwhile, other countries, like Germany, have been lagging behind. But, more recently, dairies located in Germany or with subsidiaries there—the first being FrieslandCampina (top agrar 2013; FrieslandCampina 2015), followed by ArlaFoods (2015) and Deutsches Milchkontor (2015)—have started to develop sustainability management concepts for their companies and milk suppliers. Similar initiatives have also occurred in other countries, for instance, New Zealand (e.g., Fonterra's Sustainable Dairying and Sustainable Manufacturing initiatives) and France (e.g., Lactalis' Sustainable Development program). Thus, it can be concluded that sustainability is an emerging issue for dairies worldwide. Still, there is no industry-wide sustainability standard applying to both dairies and farmers but a multifaceted picture of company-specific sustainability schemes.

One key success factor for the implementation of a sustainability standard, whether a uniform industry-wide or a firm-specific standard, is farmers' acceptance (Gocsik et al. 2014) but very little is currently known about farmers' attitudes on this subject. This observation also holds true with regard to large-scale future-oriented dairy farmers, who are considered an important target group for dairies due to their long-term willingness to stay in milk production and increase output quantities. Against this background, this study was designed to investigate future-oriented dairy farmers' acceptance of a sustainability standard and to differentiate groups of farmers based on their acceptance. The results of this study suggest managerial implications for dairies to implement sustainability management for their future-oriented suppliers and tailor their sustainability standards to their farmers' expectations.

The remainder of the paper is organized as follows: The theoretical background is described in section 2 and our methodology in section 3. The fourth section provides an overview of our empirical results. The paper closes with a discussion of the results and conclusions.

DOI 2016: pfsd.2016.1648

2. Theoretical background

Research dealing with dairy farmers' acceptance of a sustainability standard is scarce. Previous studies tend to take definitional approaches to sustainability in the dairy industry (Refsgaard et al. 1998; Armstrong/Pajor 2001; Santarossa et al. 2004; van Calker et al. 2004, 2005, 2007; Meul et al. 2009, 2012; Camarillo et al. 2012; Lassen et al. 2014). Despite these various attempts to define what sustainability means in the dairy sector, the concept is still diverse and imprecise in its definition and merely refers to a general management approach. Empirical studies on sustainability management in the dairy sector are mostly limited to a few preliminary studies on how firms interpret and implement sustainability (Gibon et al. 1999; van Calker 2005; Friedrich et al. 2012). In fact, there is currently no literature at all on dairy farmers' acceptance of a sustainability standard.

One frequently used model investigating the prediction of acceptance is the Technology Acceptance Model (TAM) proposed by Davis (1989). It mainly describes the link between factors such as attitudes or beliefs, on the one hand, and the intention to use and the actual use of a technology, on the other (Davis 1986, 1989). The central elements of Davis' (1989) TAM are *perceived usefulness* and *perceived ease of use*. The former describes users' belief to improve the job performance when using the technology. The latter can be interpreted as the user's perception of the convenience of a given system. These factors influence the *intention to use* a technology and affect its overall actual use (Davis 1989; Vogelsang et al. 2013). In the TAM, the term *technology* is used in a broad sociological sense including any substitution of equipment for human labor (Blau et al. 1976: 21); it can therefore embrace industrial production techniques, information and communication technologies, and management techniques, such as certification systems or standards.

Davis (1989) postulates that the relationship between the *perceived usefulness* of and the *intention to use* a technology is the significantly strongest factor in his model to explain users' acceptance of a technology. Studies on farmers' and agribusiness firms' acceptance of technologies also asserts that *perceived usefulness* is significantly important for the acceptance of and, consequently, the use of any given technology (Jahn/Spiller 2005; Arens et al. 2012; Voss et al. 2009; Heyder et al. 2012). In another study, Davis et al. (1992) confirmed the high impact of *perceived usefulness* and *intention to use* on users' acceptance.

Additionally, Davis et al. (1992) identified a further factor—*users' motivation*—as important for the acceptance of a technology. Psychological research distinguishes between *intrinsic* and *extrinsic* sources of motivation (Deci 1972; Scott et al. 1988). *Intrinsic motivation* relates to inner incentives, such as enjoyment of the activity itself (Berlyne 1966; Ryan/Deci 2000). *Extrinsic motivation* is defined as external reasons for a person to act a certain way, for example, financial reward or a better job performance review (e.g. Vroom 1964; Lawler/Porter 1967; Ryan/Deci 2000). Literature about land conservancy as a sustainable farm management practice shows that farmers are highly motivated to accept sustainability on the basis of economic incentives (cf. Morris et al. 2000). Kjaernes et al. (2007) and Franz et al. (2012) showed that financial incentives are a primary motivation for farmers to accept and implement animal welfare standards. This can be confirmed by the current introduction and implementation of the project 'Inititative Tierwohl' initiated by German food retailers, meat industry and agriculture associations. A lot of farmers are prepared to face up to the requirements of the initiative. They expect a higher product price and an associated competitive advantage for an improved animal welfare commitment (Initiative Tierwohl 2016; top agrar 2016). But farmers' long-term acceptance is also driven by *intrinsic*

DOI 2016: pfsd.2016.1648

motivation, such as society's recognition of their commitment to sustainable farming practices or their personal belief in and involvement in the sustainable activities (Källström/Ljung 2005; Schenk et al. 2007; Bewket 2007; Sattler/Nagel 2010; Mzoughi 2011). Additionally, farmers' willingness to accept changes in their production processes is another important factor in their acceptance of sustainability standards. Studies about the implementation of sustainability programs have indicated that farmers are skeptical about adjusting their production processes to higher sustainability because of the high economic risks they perceive to be involved. The willingness of suppliers or consumers to pay more for higher sustainability standards is also uncertain and could explain why farmers are more willing to retain their existing—although in many cases less sustainable—production processes (cf. Duffy/Fearne 2009; Rodriguez et al. 2009; Deimel et al. 2010).

Thus, with regard to the acceptance of new technologies such sustainability standards by farmers, at least five decisive factors can be derived from the existing research: perceived usefulness, intention to use a standard, extrinsic motivation, intrinsic motivation, and willingness to accept process changes. Below, future-oriented dairy farmers' acceptance of a sustainability standard is analyzed.

3. Methodology

To answer the research question, a web-based survey of farmers' perceptions of and attitudes towards alternative sustainability standards in dairy farming was distributed in March and April 2015. The questionnaire comprised three sections: Sociodemographic characteristics were gathered in the first part, followed by an evaluation of farmers' acceptance of a sustainability standard and their motivation to participate and, finally, a request for farm characteristics. The survey contained primarily closed questions to be answered on five-point Likert scales[1]. After a pre-test the questionnaire was sent to a public available list of agricultural training companies as well as dairies, which distributed the survey to their customers. A total of 230 dairy farmers in Germany answered the questionnaire. Future-oriented farmers were identified by means of a question about their operational planning, categorizing them as future-oriented if they planned either to increase or to remain with their current production amount and not future-oriented if they planned to give up milk production in the medium term. This screening left 212 future-oriented dairy farmers in the sample whereby the information value to this partial sample. The statistical analysis was conducted using IBM SPSS Statistics 23. To characterize the sample, descriptive statistics such as frequency distributions, mean values (μ) and standard deviations (SD) were used (Backhaus et al. 2008; Bühl 2010). A cluster analysis was also conducted, in which significant differences between cluster-groups were identified, providing meaningful insights into the characteristics of the clusters.

[1] Scale: -2= strongly disagree to +2= strongly agree and -2=very unimportant to +2=very important.

DOI 2016: pfsd.2016.1648

4. Results

4.1. Sample description

Since the focus in this study lay on future-oriented dairy farms, the share of larger farms is higher than in the general population. Concerning their future strategic orientation, 47.4% of the respondents intend to remain with their current production volume, whereas 52.6% plan to increase their milk production in the future. Tab. 1 gives an overview of the main farm characteristics in comparison to average dairy farms in Germany.

Tab. 1: Farm characteristics of the sample in comparison to average dairy farms in Germany

	Sample	German average
Farm size (ha)	417	58.6
Proportion of grassland (%)	26	28
Ø Herd size (number of dairy cows per farm)	230	57
Ø Amount of milk per cow and year (kg)	9,001	7,541

Source: Authors' calculation; Destatis 2013; DBV 2014; Statista 2014; 2015.

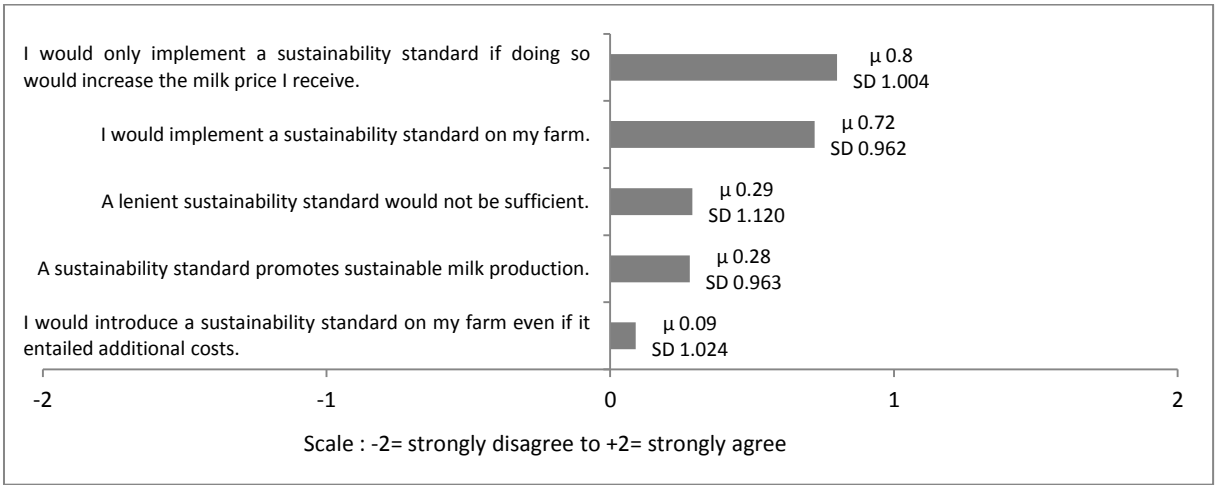
Tab. 1 makes it obvious that the farms in the sample are in every respect larger than the average German dairy farm. In the sample, farms are approximately eight times larger than an average German dairy farm (417 vs. 58.6 ha) (Destatis 2013; DBV 2014). Farmers in the sample keep on average 230 cows, whereas the average German herd size is only 57 cows (Statista 2015). In the sample, the average milk yield, which is a central key indicator of efficiency, is 9,001 kg per cow and year and, thus, higher than the German average of 7,541 kg per cow and year (Statista 2014). This shows that the sample consists of farms with an appropriate herd management as the quality of the herd management is highly correlated with milk quality and animal health and finally with the milk yield. Nowadays high-yield cows give on average 9,000 to 10,000 kg milk per day (Busch et al. 2004).

Except for two farmers, respondents manage their farms on a full-time basis. Of the farms surveyed, 7.1% produce organic milk. The farms in our survey are managed mostly by their owners (84.8%) or their successors (10.9%). Respondents in the sample are on average 46 years old and have 24 years of work experience. Most respondents completed some level of higher education, as 32.7% attended university and 30.8 % completed advanced training in agriculture.

Overall, farmers have a positive attitude concerning sustainability as 84.4 percent value it as necessary and 80.5 percent as reasonable. 90 percent of the respondents state that they have already implemented aspects of sustainability. With a more precise view it can be shown that the future-oriented farmers in our study provided a diverse picture concerning their acceptance of a sustainability standard. (See Fig. 1.)

DOI 2016: pfsd.2016.1648

Fig. 1: Future-oriented farmers' acceptance of a sustainability standard (N=211)



In general, the farmers evinced a positive attitude concerning the implementation of a sustainability standard on their farms (μ = 0.72), but they tended to be indifferent when asked about their intrinsic motivation to introduce a standard even if it were to entail costs (μ = 0.09). Their opinions also differed on whether a sustainability standard promotes sustainable milk production (μ = 0.28) and whether a lenient sustainability standard would suffice (μ = 0.29). On average, the farmers' responses showed that they are extrinsically motivated in implementing a standard especially if it would bring them a higher milk price. For all questions, there was a high standard deviation, which reflects a broad distribution in the measured values (Bühl 2010). These findings support the use of a cluster analysis to identify differences between groups in farmers' acceptance of a sustainability standard.

4.2. Results of the cluster analysis

A hierarchical agglomerative cluster analysis was conducted to identify different groups of farmers in the sample based on their attitudes towards sustainability standards. The variables reflecting farmers' acceptance of a sustainability standard, were derived from the literature (see section 2) and used as cluster-building variables. Hence, *perceived usefulness* (Davis 1989, Davis et al. 1992), *intention to use* a standard (Davis 1989, Davis et al. 1992), *extrinsic motivation* (Ryan/Deci 2000; Kjaernes et al. 2007; Franz et al. 2012), *intrinsic motivation* (Källström/Ljung 2005; Schenk et al. 2007; Bewket 2007; Sattler/Nagel 2010; Mzoughi 2011) and farmers' *willingness to change* their current production processes (Rodriguez et al. 2009; Duffy/Fearne 2009; Deimel et al. 2010) are used as cluster-building variables to merge respondents into homogenous groups (see Tab. 2). Respondents with the least dissention were combined using the single-linkage procedure. During this analysis, one outlier was identified, leaving 211 respondents. To identify the optimal cluster solution, the Ward method was employed to combine respondents, which minimally increased the variance in the cluster group. Applying the elbow criteria yielded three clusters. By using the k-means method, the solution was determined in six iterations. Finally, discriminant analysis confirmed that 96.7% of the cases originally grouped had been correctly classified.

DOI 2016: pfsd.2016.1648

All in all, three distinct clusters were identified. The cluster-building variables are described in Tab. 2 using a univariate variance analysis (ANOVA). A post hoc test (Tamhane's T2 or LSD), yielded the differences in the mean value (Backhaus et al. 2008; Bühl 2010).

Tab. 2: Cluster building variables

Statements[2]		Cluster 1 N=98 46.4%	Cluster 2 N=59 27.9%	Cluster 3 N=54 25.7%	Total N=211	ANOVA p-value[1]
I would implement a sustainability standard on my farm.	μ SD	0.74^{bc} 0.647	1.58^{ac} 0.498	-0.26^{ab} 0.915	0.72 0.962	0.000***
A sustainability standard promotes sustainable milk production.	μ SD	0.27^{bc} 0.711	1.08^{ac} 0.624	-0.56^{ab} 0.945	0.28 0.963	0.000***
I would introduce a sustainability standard on my farm even it entailed costs.	μ SD	0.06^{bc} 0.553	1.2^{ac} 0.55	-1.06^{ab} 0.738	0.09 1.024	0.000***
I would only implement a sustainability standard if doing so would increase the milk price I receive.	μ SD	0.72^{ef} 0.847	0.32^{df} 1.09	1.46^{de} 0.818	0.8 1.004	0.000***
A lenient sustainability standard would not be sufficient.	μ SD	0.22^{bc} 0.806	-0.69^{ac} 0.915	1.48^{ab} 0.574	0.29 1.120	0.000***

[1]Level of significance: n.s.=not significant; p≤0.1 slightly significant[$]; p≤0.05 significant*; p≤0.01 very significant**; p≤0.001 highly significant***; [2]Scale: -2= strongly disagree to +2= strongly agree; [abc]Significant differences between the clusters on the level of significance 0.05 (post hoc test – Tamhane's T2); [def]Significant differences between the clusters on the level of significance 0.05 (post hoc test – LSD)

With 98 respondents, cluster 1 is the largest cluster in this analysis. The farmers in this cluster take an undecided position towards a sustainability standard. They can imagine implementing a standard, but they are indifferent as to whether a standard promotes sustainable milk production. In general, they have only limited motivation to accept a standard even if financial incentives are provided. Therefore, they can be described as *half-hearted sustainability proponents*.

The second cluster contains 59 farmers who indicated strong acceptance of sustainability. Respondents strongly agreed that they can imagine implementing a sustainability standard and believe that such a standard promotes sustainable milk production. Farmers in this group are intrinsically motivated to implement a sustainability standard since they stated that they would do so even if it entailed costs. Farmers in this group are indifferent concerning their extrinsic or financial motivation to implement a standard, and they have a negative attitude towards a lenient sustainable standard. We therefore labeled this group *highly dedicated sustainability proponents*.

Cluster 3 is the smallest group and contains only 54 respondents. These farmers would not voluntarily accept a sustainability standard. They are indifferent concerning the implementation of such a standard on their farm and disagree with the idea that a sustainability standard promotes sustainable milk production. They would not

DOI 2016: pfsd.2016.1648

implement a standard if it entailed costs but would be highly motivated to do so if there were financial incentives for its implementation. This cluster can be described as *profit-oriented sustainability refusers*.

The ANOVA identified significant differences between the clusters concerning their socio-demographic characteristics (see Tab. 3). The average age (rounded up) of the respondents was 46 years (N=211). The post hoc test (Tamhane's T2) identified a very significant difference (p=0.003**) between the *halfhearted sustainability proponents* (Cluster 1) and the *highly dedicated sustainability proponents* (Cluster 2). The latter group contains the oldest farmers (average age = 49) as well as the farmers with the most work experience compared to the other groups. The *profit-oriented sustainability refusers* (Cluster 3) are, on average, 46 years old; with regard to age and work experience, the farmers in this group are located between the other two groups. The *highly dedicated sustainability proponents* (Cluster 2) have the most work experience compared to the other two clusters.

Tab. 3: Differences between clusters and socio-demographic characteristics

Sociodemographic characteristics		Cluster 1 N=98 46.4%	Cluster 2 N=59 27.9%	Cluster 3 N=54 25.7%	Total N=211	ANOVA p-value[1]
Age (in years)	μ SD	43.99[b] 9.58	48.97[a] 8.534	46.13 10.749	45.93 9.799	0.008**
Work experience (in years)	μ SD	22.71 11.112	26 10.56	24.78 11.503	24.16 11.102	0.179[n.s.]
Share of total income from milk production (%)	μ SD	65.45% 21.247	73.76% 20.873	68.19% 20.697	68.47% 21.192	0.058[$]

[1]Level of significance: n.s.=not significant; p≤0.1 slightly significant[$]; p≤0.05 significant*; p≤0.01 very significant**; p≤0.001 highly significant***; [abc]Significant differences between the clusters on the level of significance 0.05 (post hoc test – Tamhane's T2)

As can be seen, there is a highly significant difference between the three clusters in the share of total income that comes from milk production. The youngest cluster with the lowest work experience—the *halfhearted sustainability proponents* (Cluster 1)—is also the one with the lowest total income stemming from milk production (65.45 percent). The *highly dedicated sustainability proponents* (Cluster 2) receive approximately three-fourths of their total income from milk production. Tab. 4 below shows the differences between the three clusters in their farm characteristics.

Tab. 4: Differences between clusters in farm characteristics

		Cluster 1 N=98 46.40%	Cluster 2 N=59 27.90%	Cluster 3 N=54 25.70%	Total N=211	ANOVA p-value[1]
Milk production (kg per cow/year)	μ SD	9064.65 1158.155	8888.37 1524.521	9009.33 1144.91	9001.2 1264.03	0.700[n.s.]
Farm size (ha)	μ SD	485.33 838.904	366.14 603	349.76 739.605	417.3 753.406	0.473[n.s.]
Herd size (number of dairy cows per farm)	μ SD	241.45 300.626	226.34 265.588	212.5 328.819	229.82 297.756	0.845[n.s.]

[1]Level of significance: n.s.=not significant; p≤0.1 slightly significant[$]; p≤0.05 significant*; p≤0.01 very significant**; p≤0.001 highly significant***

DOI 2016: pfsd.2016.1648

The clusters do not differ significantly with regard to their farm characteristics, but trends can be derived from cross tabulations. In general, all three clusters show a high amount of milk production per cow per year. The *highly dedicated sustainability proponents* (Cluster 2) produce less in comparison to the other clusters. A closer look at the cross tabulation indicates that 44.5 percent of the *profit-oriented sustainability refusers* (Cluster 3) produce less than 8,900 kg per cow/year, whereas 35.5 percent of the *highly dedicated sustainability proponents* (Cluster 2) produce more than 9,700 kg per cow/year. Of the *halfhearted sustainability proponents* (Cluster 1), 30.6 percent produce between 9,000 kg and 9,600 kg per cow and year. Farmers in this group cultivate the largest farms—averaging 485.33 ha.

As stated in the sample description, the average annual herd size on the farms surveyed is high above the German average. The number of cows does not differ significantly between the clusters, but a more detailed look at the cross tabulation reveals that 32.2 percent of the *highly dedicated sustainability proponents* (Cluster 2) have a herd size of more than 100 cows per year. In contrast, 42.6 percent of the *profit-oriented sustainability refusers* (Cluster 3) keep fewer than 70 cows.

4.3. Clusters' attitudes and motivation for implementing a sustainability standard

Farmers have different reasons to accept a sustainability standard. Two statements describing the intrinsic and the financial motivation of farmers have already been used and described above as cluster-building variables. Three more groups of motivational factors are shown in tables below: effects on the image of agriculture and societal pressure (Tab. 5), financial incentives (Tab. 6) and production and competition (Tab. 7).

Tab. 5: Motivations for accepting a sustainability standard: Image and social pressure

		Cluster 1 N=98 46.40%	Cluster 2 N=59 27.90%	Cluster 3 N=54 25.70%	Total N=211	ANOVA p-value[1]
The image of agriculture can be improved through a sustainability standard.[3]	μ SD	1.05[ef] 0.924	1.58[df] 0.7	0.39[de] 1.352	1.03 1.086	0.000***
An effective communication about a sustainable production can help to remove wrong ideas about milk production.[2]	μ SD	0.97[f] 0.831	1.12[f] 0.79	0.43[de] 1.175	0.87 0.955	0.000***
A sustainable standard becomes essential because of societies' requirements.[2]	μ SD	0.63[ef] 0.89	1.34[df] 0.576	-0.19[de] 1.065	0.62 1.027	0.000***

[1]Level of significance: n.s.=non-significant; p≤0.1 slightly significant[$]; p≤0.05 significant*; p≤0.01 very significant**; p≤0.001 highly significant***; [2]Scale : -2= strongly disagree to +2= strongly agree; [3]Scale: -2=very unimportant to +2=very important; [def]Significant differences between the clusters on the level of significance 0.05 (post hoc test – LSD)

Tab. 5 indicates that there are highly significant differences between the three clusters regarding motivation. The *halfhearted sustainability proponents* (Cluster 1) and the *highly dedicated sustainability proponents* (Cluster 2) believe that the image of agriculture can be increased through a sustainability standard, whereas the *profit-oriented sustainability refusers* (Cluster 3) are generally indifferent regarding this statement. All three

DOI 2016: pfsd.2016.1648

clusters tend to agree that effective communication about sustainable production can help remove incorrect ideas about milk production. Support for this statement is strongest in Cluster 2. For the *highly dedicated sustainability proponents* (Cluster 2), a sustainable standard is becoming essential because of society's demands, whereas the *halfhearted sustainability proponents* (Cluster 1) tend to be indifferent and the *profit-oriented sustainability refusers* (Cluster 3) tend to reject this statement.

Tab. 6: Motivations for accepting a sustainability standard: Financial incentives

		Cluster 1 N=98 46.40%	Cluster 2 N=59 27.90%	Cluster 3 N=54 25.70%	Total N=211	ANOVA p-value[1]
Consumers realize and honor a standard for more sustainable milk production and pay more for the products.[3]	μ SD	1.02[f] 1.093	1.36[f] 0.783	0.33[de] 1.554	0.94 1.215	0.000***
Sustainable milk production has a positive influence on the financial success of the farm.[2]	μ SD	0.1[ef] 0.793	0.78[df] 0.789	-0.48[de] 1.094	0.14 0.99	0.000***
[1]Level of significance: n.s.=non-significant; p≤0.1 slightly significant[$]; p≤0.05 significant*; p≤0.01 very significant**; p≤0.001 highly significant***; [2]Scale: -2= strongly disagree to +2= strongly agree; [3]Scale: -2=very unimportant to +2=very important; [def]Significant differences between the clusters on the level of significance 0.05 (post hoc test – LSD)						

The three clusters differ highly significantly regarding their opinion as to whether consumers recognize and honor a standard for more sustainable milk production and have a higher willingness-to-pay for the products. Clusters 1 and 2 agree with this idea, whereas farmers in Cluster 3 are indifferent. Sustainability has a clear impact on financial success for the *highly dedicated sustainability proponents* (Cluster 2). The *halfhearted sustainability proponents* (Cluster 1) are indifferent towards this statement, whereas the *profit-oriented sustainability refusers* (Cluster 3) deny that sustainability has a positive influence on a farm's financial performance.

With regard to market- and production-driven motivations for implementing a sustainability standard, there are also highly significant differences between the three clusters.

Tab. 7: Motivations for accepting a sustainability standard: Market and production

		Cluster 1 N=98 46.40%	Cluster 2 N=59 27.90%	Cluster 3 N=54 25.70%	Total N=211	ANOVA p-value[1]
Sustainable milk production is an important competitive advantage in a rival market.[2]	μ SD	0.28[b] 0.917	1.12[ac] 0.873	-0.02[b] 1.073	0.44 1.042	0.000***
Sustainable milk production is a good tool for reacting to volatile milk prices after the elimination of milk quotas.[2]	μ SD	-0.07[b] 1.086	0.36[ac] 0.905	-0.46[b] 1.128	-0.05 1.088	0.000***

DOI 2016: pfsd.2016.1648

A standard for sustainable milk production means more documentation but also improved knowledge of the production.[2]	μ SD	0.61[e] 0.904	0.98[df] 0.799	0.39[e] 1.172	0.66 0.975	0.004**
Production processes and quality will improve through sustainable milk production.[2]	μ SD	0.22[ef] 0.925	0.86[df] 0.681	-0.31[de] 1.13	0.27 1.017	0.000***
Animal health and milk quality are positively impacted by sustainable milk production.[2]	μ SD	0.66[ef] 0.812	1.19[df] 0.682	-0.09[de] 1.17	0.62 1	0.000***

[1]Level of significance: n.s.=non-significant; p≤0.1 slightly significant[$]; p≤0.05 significant*; p≤0.01 very significant**; p≤0.001 highly significant***; [2]Scale: -2= strongly disagree to +2= strongly agree; [abc] Significant differences between the clusters on the level of significance 0.05 (post hoc test – Tamhane's T2); [def] Significant differences between the clusters on the level of significance 0.05 (post hoc test – LSD)

For the *highly motivated farmers* (Cluster 2), sustainable milk production represents an important competitive advantage in the market. The other clusters tend to be indifferent towards this statement. Both the *highly motivated sustainable proponents* (Cluster 2) and the *halfhearted sustainable proponents* (Cluster 1) tend to be indifferent towards the proposition that more sustainable milk production would be a good tool for reacting to volatile milk prices after the end of the European milk quota system. Hardly surprisingly, farmers with negative attitudes towards sustainability (Cluster 3) disagree with that statement.

Both the *highly dedicated sustainability proponents* (Cluster 2) and the *halfhearted sustainability proponents* (Cluster 1) agree that sustainability involves more documentation but also improved knowledge of production. The *profit-oriented sustainability refusers* (Cluster 3), however, are indifferent towards that statement. The *highly dedicated sustainability proponents* (Cluster 2) believe that sustainability also leads to better production processes and product quality. The *halfhearted sustainability proponents* (Cluster 1), who are indifferent concerning whether or not sustainability has a positive impact on the production process, agree that it has a positive influence on animal health and milk quality. The *highly dedicated sustainability proponents* (cluster 2) strongly endorse that sustainability has a positive influence on animal health and milk quality as well on production processes and quality.

5. Discussion and conclusions

This study is set out to classify groups of future-oriented dairy farmers' based on their acceptance of the implementation of a sustainability standard. The results show that, in general, future-oriented farmers would implement a comprehensive sustainability standard. This is in contrast with the results of former studies on farmers' acceptance of and willingness to participate in programs for the improvement of specific sustainability standards, for instance, those regarding animal welfare or environmental protection (Bewket 2007; Schenk et al. 2007; Kjaernes et al. 2007). The premise for the successful implementation of a sustainability standard is farmers' acceptance (cf. Ahnström et al. 2009; Gocsik et al. 2014).

DOI 2016: pfsd.2016.1648

In general, farmers' basic approval affirms the potential for dairies to focus on the development of their sustainability strategies and the implementation of a standard. The establishment of a sustainability standard can improve dairies' competitive advantage to settle and encourage their market position and therefore to realize a higher product price (cf. Porter/Kramer 2006; Svensson/Wagner 2012). Further, a more sustainable production process along the whole supply chain can be enabled.

In respect to the results from this study dairies should focus on their target groups to motivate farmers individually to participate in sustainability programs. A closer look at farmers' acceptance shows high standard deviations that affirm the choice of a cluster analysis. With a more precise examination of the sample, this impression was confirmed. Respondents in the present study vary broadly in their acceptance of a sustainability standard. In general, this implies the need for targeted and precisely tailored sustainability management on the part of dairies. With the help of a cluster analysis, we identified and examined three groups of future-oriented dairy farmers, who differed significantly in their attitudes towards and acceptance of sustainability but less regarding socio-demographic and farm characteristics. Two clusters (the *highly dedicated sustainability proponents* and the *halfhearted sustainability proponents*) evinced a generally positive attitude towards a sustainability standard as well as its implementation and recognized the positive influence of sustainability on farmers' image, production quality and financial success. These two groups of farmers are either highly intrinsically motivated to accept a sustainability standard, or their acceptance is determined by financial motives. The latter is also an important incentive for the group of *profit-oriented sustainability refusers*, who generally have a negative opinion regarding the usefulness of a sustainability standard and are unconvinced of its positive effects on production processes or financial success. Nevertheless, a financial reward would be a major incentive for this third group to implement a sustainability standard, which confirms the findings of former studies on the acceptance of animal welfare or environmental standards (cf. Morris et al. 2000; Kjaernes et al. 2007; Franz et al. 2012). From the literature, it is clear that involving farmers' in the process of sustainability management improves their acceptance and should therefore be considered for inclusion among dairies' communication strategies (cf. Källström/Ljung 2005; Schenk et al. 2007; Bewket 2007). With regard to sociodemographic and farm characteristics, age is the only factor that differs significantly among the groups. The *highly dedicated sustainability proponents* are the oldest group. This result is in contrast with former studies, which found that younger farmers are more interested in sustainable agriculture (cf. Comer et al. 1999).

Due to the rather small sample size and the limited variance in sociodemographic and farm characteristics of the subsample, the survey is not representative of the population of all dairy farmers. Therefore, there is a need for future research on implementing a sustainability standard in the dairy sector. Another area of interest is to determine which factors exert the most influence on farmers' motivation and adoption of a sustainability standard in dairy as well as in other agricultural subsectors.

References

DOI 2016: pfsd.2016.1648

Ahnström, J., Höckert, J., Bergeå, H.L., Francis, C.A., Skelton, P., Hallgren, L. (2009): Farmers and nature conservation: What is known about attitudes, context factors and actions affecting conservation? Renewable Agriculture and Food Systems, 24(1), 38-47.

Arens, L., Plumeyer, C.-H., Theuvsen, L. (2012): Determinants of the Use of Information: An Empirical Study of German Pig Farmers. International Food and Agribusiness Management Review, 15(1), 51-72.

ArlaFoods (2015): Nachhaltigkeit. (19.12.2015), URL: www.arlafoods.de/ubersicht/nachhaltigkeit/.

Armstrong, J.D. & Pajor, E.A. (2001): Changes in animal welfare needed to maintain social sustainability. Livestock Environment VI, Proceedings of the 6th International Symposium 2001. American Society of Agricultural and Biological Engineers.

Backhaus, K., Erichson, B., Plinke, W., Weiber, R. (2008): Multivariate Analysemethoden: Eine anwendungsorientierte Einführung. Berlin, Heidelberg: Springer Verlag.

Berlyne, D.E. (1966): Curiosity and exploration. Science, 153(3731), 25-33.

Bewket, W. (2007): Soil and water conservation intervention with conventional technologies in northwestern highlands of Ethiopia: Acceptance and adoption by farmers. Land Use Policy 24(2), 404-416.

Blau, P., McHugh-Falbe, C., McKinley, W., Phelps, T. (1976): Technology and Organization in Manufacturing. Administrative Science Quarterly, 21(1), 20-40.

Bühl, A. (2010): SPSS 18 – Einführung in die moderne Datenanalyse. München: Pearson Studium.

Busch, W., Methling, W., Amselgruber, W.M. (2004): Tiergesundheits-und Tierkrankheitslehre. Stuttgart: Georg Thieme Verlag.

Camarillo, M.K., Stringfellow, W.T., Jue, M.B., Hanlon, J.S. (2012): Economic sustainability of a biomass energy project located at a dairy in California, USA. Energy Policy, 48, 790-798.

Comer, S., Ekanem, E., Muhammad, S., Singh, S.P., Tegegne, F. (1999): Sustainable and conventional farmers: A comparison of socio-economic characteristics, attitude, and beliefs. Journal of Sustainable Agriculture, 15(1), 29-45.

Crane, A. & Matten, D. (2004): Business Ethics. A European Perspective. Oxford: University Press.

Davis, F.D. (1986): A technology acceptance model for empirically testing new end-user information systems: Theory and results. Doctoral dissertation, University of Cambridge.

Davis, F.D. (1989): Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13(3), 319-340.

Davis, F.D., Bagozzi, R.P., Warshaw, P.R. (1992): Extrinsic and intrinsic motivation to use computers in the workplace. Journal of Applied Social Psychology, 22(14), 1111-1132.

Deci, E.L. (1972): Intrinsic motivation, extrinsic reinforcement, and inequity. Journal of Personality and Social Psychology, 22(1), 113-120.

Deimel, I., Franz, A., Frentrup, M., von Meyer, M., Spiller, A., Theuvsen, L. (2010): Perspektiven für ein Europäisches Tierschutzlabel. (13.06.2015), URL: http://download.ble.de/08HS010.pdf.

Destatis (2013): Landwirtschaftlich genutzte Fläche 2013: 71 % sind Ackerland. (20.11.2015), URL: www.destatis.de/DE/ZahlenFakten/Wirtschaftsbereiche/LandForstwirtschaftFischerei/FeldfruechteGruenland/AktuellFeldfruechte1.html.

Destatis (2015): Deutschland größter Milcherzeuger in der EU. (28.09.2015), URL: https://www.destatis.de/Europa/DE/Thema/LandForstwirtschaft/LandForstwirtschaft.html.

Deutscher Bauernverband (DBV) (2014): Situationsbericht 2014/15. Trends und Fakten zur Landwirtschaft. Berlin: Deutscher Bauernverband e.V.

Deutsches Milchkontor (2015): Nachhaltigkeit. (19.12.2015), URL: www.dmk.de/de/verantwortung/nachhaltigkeit/strategie/.

Doluschitz, R. (2009): Der europäische Milchmarkt im Umbruch – Neue Herausforderungen für Milcherzeuger und Molkereigenossenschaften in Baden-Württemberg. Berichte über Landwirtschaft, 87(2), 197-213.

Dries, L., Germenji, E., Noev, N., Swinnen, J.F.M. (2009): Farmers, Vertical Coordination, and the Restructuring of Dairy Supply Chains in Central and Eastern Europe. World Development, 37(11), 1742–1758.

Duffy, R. & Fearne, A. (2009): Value perceptions of farm assurance in the red meat supply chain. British Food Journal, 111(7), 669-685.

DOI 2016: pfsd.2016.1648

Flint, D.J. & Golicic, S.L. (2009): Searching for competitive advantage through sustainability: A qualitative study in the New Zealand wine industry. International Journal of Physical Distribution & Logistics Management, 39(10), 841-860.

Franz, A., Deimel, I., Spiller, A. (2012): Concerns about animal welfare: a cluster analysis of German pig farmers. British Food Journal, 114(10), 1445-1462.

Friedrich, N., Heyder, M., Theuvsen L. (2012): Sustainability Management in Agribusiness: Challenges, Concepts, Responsibilities and Performance. International Journal on Food System Dynamics, 3(2), 123-135.

FrieslandCampina (2015): CSR in practice. (19.12.2015), URL: www.frieslandcampina.com/en/sustainability/csr-cases/.

Gauly, M. (2015): Was können wir in der Milchviehhaltung besser machen? LfL Jahrestagung: Die bayerische Milchwirtschaft im freien Wettbewerb, 22nd October 2015, Grub, Germany.

Gibon, A., Sibbald, A.R., Flamant, J.C., Lhoste, P., Revilla, R., Rubino, R., Sørensen, J.T. (1999): Livestock farming systems research in Europe and its potential contribution for managing towards sustainability in livestock farming. Livestock Production Science, 61(2), 121-137.

Gocsik, E., Saatkamp, H.W., De Lauwere, C.C., Oude Lansink, A.G.J.M. (2014): A Conceptual Approach for a Quantitative Economic Analysis of Farmers' Decision- Making Regarding Animal Welfare. Journal of Agricultural and Environmental Ethics, 27(2), 287-308.

Hartmann, M. (2001): The Dairy Sector in the Central European Candidate (CEC) Countries - The Status of Restructuring and Future Challenges. German Journal of Agricultural Economics, 50(6), 342-353.

Heyder, M. & Theuvsen, L. (2012): Determinants and effects of corporate social responsibility in German agribusiness: A PLS model. Agribusiness, 28(4), 400-428.

Heyder, M., Theuvsen, L., Hollmann-Hespos, T. (2012): Investments in Tracking and Tracing Systems in the Food Industry: A PLS Analysis. Food Policy, 37(1), 102-113.

Initiative Tierwohl (2016): Initiative Tierwohl. (16.01.2016), URL: www.initiative-tierwohl.de.

Innovation Center for U.S. Dairy (2015): Sustainability. (23.12.2015), URL: http://www.usdairy.com/sustainability/industry-commitment.

Jahn, G. & Spiller, A. (2005): Acceptance of a processor-driven quality management system by dairy farmers: A structural equation model, conference proceedings presented at 92nd EAAE Seminar on 'Quality Management and Quality Assurance in Food Chains', 2nd-4th March 2005, Goettingen, Germany.

Källström, H.N. & Ljung, M. (2005): Social sustainability and collaborative learning. AMBIO: A Journal of the Human Environment, 34(4), 376-382.

Kjaernes, U., Miele, M., Roex, J. (2007): Attitudes of Consumers, Retailers and Producers to Farm Animal Welfare. Welfare Quality Report (No. 2). (7.06.2015), URL: www.cardiff.ac.uk/cplan/sites/de¬fault/files/WQReport-2_0.pdf.

Kühl, S., Ermann, M., Spiller, A. (2014): Imageträger Weidemilch. DLG-Mitteilungen, 4/2014.

Lassen, B., Nieberg, H., Kuhnert, H., Sanders, J. (2014): Status-quo-Analyse ausgewählter Nachhaltigkeitsaspekte der Milcherzeugung in Niedersachsen (No. 28). Thünen Working Paper.

Lawler, E.E. & Porter, L.W. (1967): Antecedent attitudes of effective managerial performance. Organizational Behavior and Human Performance, 2(2), 122-142.

Meul, M., Nevens, F., Reheul, D. (2009): Validating sustainability indicators: focus on ecological aspects of Flemish dairy farms. Ecological Indicators 9(2), 284-295.

Meul, M., van Passel, S., Fremaut, D., Haesaert, G. (2012): Higher sustainability performance of intensive grazing versus zero-grazing dairy systems. Agronomy for Sustainable Development, 32(3), 629-638.

Milchtrends.de (2015): Milchverarbeitung in Deutschland. (05.09.2015), URL: www.milchtrends.de/index.php?id=7755.

Morris, J., Mills, J., Crawford, I.M. (2000): Promoting farmer uptake of agri-environment schemes: the Countryside Stewardship Arable Options Scheme. Land Use Policy, 17(3), 241-254.

Mzoughi, N. (2011): Farmers adoption of integrated crop protection and organic farming: Do moral and social concerns matter? Ecological Economics, 70(8), 1536-1545.

Origin green (2015): Origin green. (23.12.2015), URL: http://www.origingreen.ie/.

DOI 2016: pfsd.2016.1648

Porter, M.E. & Kramer, M.R. (2006): The link between competitive advantage and corporate social responsibility. Harvard Business Review, 84(12), 78-92.

Refsgaard, K., Halberg, K., Kristensen, E.S. (1998): Energy utilization in crop and dairy production in organic and conventional livestock production systems. Agricultural Systems, 57(4), 599-630.

Rodriguez, J.M., Molnar, J.J., Fazio, R.A., Sydnor, E., Lowe, M.J. (2009): Barriers to adoption of sustainable agriculture practices: Change agent perspectives. Renewable Agriculture and Food Systems, 24(1), 60-71.

Ryan, R.M. & Deci, E.L. (2000): Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions. Contemporary Educational Psychology, 25(1), 54-67.

Santarossa, J.M., Stott, A.W., Woolliams, J.A., Brotherstone, S., Wall, E., Coffey, M.P. (2004): Economic evaluation of long-term sustainability in the dairy sector. Animal Science, 79(11), 315-325.

Sattler, C. & Nagel, U.J. (2010): Factors affecting farmers' acceptance of conservation measures – A case study from north-eastern Germany. Land Use Policy, 27(1), 70-77.

Schenk, A., Hunziker, M., Kienast, F. (2007): Factors influencing the acceptance of nature conservation measures qualitative study in Switzerland. Journal of Environmental Management, 83(1), 66-79.

Schodl, K., Leeb, C., Winckler, C. (2015): Developing science–industry collaborations into a transdisciplinary process: a case study on improving sustainability of pork production. Sustainability Science, 10(4), 639-651.

Scott, W.E., Farh, J., Podaskoff, P.M. (1988): The effects of "intrinsic" and "extrinsic" reinforcement contingencies on task behavior. Organizational Behavior and Human Decision Processes, 41(3), 405-425.

Statista (2014): Milchleistung je Kuh in Deutschland in den Jahren 1900 bis 2014 (in Kilogramm). (20.11.2015), URL: http://de.statista.com/statistik/daten/studie/153061/umfrage/ durchschnittlicher-milchertrag-je-kuh-in-deutschland-seit-2000/.

Statista (2015): Anzahl der Milchkühe je Betrieb in Deutschland nach Bundesländern im Jahr 2015. (20.11.2015), URL: http://de.statista.com/statistik/daten/studie/382322/umfrage/ milchkuehe-je-betrieb-in-deutschland-nach-bundeslaendern/.

Svensson, G., & Wagner, B. (2012): Implementation of a sustainable business cycle: the case of a Swedish dairy producer. Supply Chain Management: An International Journal, 17(1), 93-97.

The Australian Dairy Industry (2015): Sustainability. (23.12.2015), URL: www.sustainabledairyoz.com.au/.

Top agrar (2013): Nachhaltigkeit: Was steckt wirklich dahinter? top agrar/ Rinder-Spezial 2/2013.

Top agrar (2016): Themenseite zur Initiative Tierwohl. (16.01.2016), URL: www.topagrar.com/Themenseite-zu-Tierwohl-und-Tierschutz-974304.html

Van Calker (2005): Sustainability of Dutch dairy farming systems: A modeling approach. Doctoral dissertation, Wageningen University.

Van Calker , K.J., Berentsen, P.B.M., Giesen, G.W.J., Huirne, R.B.M. (2005): Identifying and ranking attributes that determine sustainability in Dutch dairy farming. Agriculture and Human Values, 22(1), 53-63.

Van Calker, K.J., Berentsen, P.B.M., De Boer, I.J.M., Giesen, G.W.J., Huirne, R.B.M. (2007): Modelling worker physical health and societal sustainability at farm level: an application to conventional and organic dairy farming. Agricultural Systems, 94(2), 205-219.

Van Calker, K.J., Berentsen, P.B.M., De Boer, I.M.J., Giesen, G.W.J., Huirne, R.B.M. (2004): An LP-model to analyse economic and ecological sustainability on Dutch dairy farms: model presentation and application for experimental farm "de Marke". Agricultural Systems, 82(2), 139-160.

Vogelsang, K., Steinhüser, M., Hoppe, U. (2013): Theorieentwicklung in der Akzeptanzforschung: Entwicklung eines Modells auf Basis einer qualitativen Studie. Wirtschaftsinformatik Proceedings 2013. Paper 89.

Voss, J., Spiller A., Enneking, U. (2009): Zur Akzeptanz von gentechnisch verändertem Saatgut in der deutschen Landwirtschaft. Agrarwirtschaft, 58(3), 155-167.

Vroom, V. (1964): Work and motivation. New York: Wiley.

DOI 2016: pfsd.2016.1648