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The Balanced Scorecard as a Management Tool for Arable Farming

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ABSTRACT

Management requirements for crop farming are high and will rise in the future. Arable farms are challenged by volatile markets, growing administrative burdens, increasing operating costs and growing competition for land. Management skills have become much more important for farmers in recent years and this trend will continue in the future. There are numerous instruments like accounting software or crop field cards integrated in daily management practice, but there is a deficiency of a fully integrated management system to give an overview of all areas of the farming business. This gap can be closed by the management tool Balanced Scorecard (BSC) that provides an overview of all production and management activities on a farm. Therefore, with the aim to transfer the BSC concept to crop farming, German farmers and agricultural advisors were surveyed to get insights into the success factors and key performance indicators in the four BSC perspectives they consider most relevant for the operational success of arable farms. By the use of a cluster analysis, three different farm types were identified according to their visions and strategies. For the three farm types the key performance indicators that the respondents considered most relevant for farm performance were figured out. Implementation of the BSC to crop farming can result in a big benefit for management practice. The BSC focuses vision and long-term strategy with the main goal to ensure consistency of the farm and increase farm performance.

Keywords. Balanced Scorecard, performance measurement, cluster analysis, crop farming

1 Introduction

Requirements for the management of farms in countries of the European Union are high and will rise even further in the future due to structural changes in agriculture, more volatile markets for agricultural products, growing administrative burdens, rising operating costs and growing competition for land (Lissitsa, 2005; Inderhees, 2006; Balmann and Schaft, 2008; Olson and Brand, 2013). Competitiveness and economic success are important factors to continue with the agricultural business. In addition to these factors the farm manager also needs an overview of market developments, the financial structure of the farm´s internal operations, stakeholder relationships and also the family got their claims. This leads to an increasing demand of management skills of farmers to secure sustainability and performance in agricultural enterprises (Doluschitz et al., 2011).

Thus, farm planning and controlling have become more important in farm management, especially for enlarged family farms, i.e. a farm type in which family labor is combined with hired wage labor in the wake of corporate growth in order to achieve economies of scale (Schaper et al., 2011). In German agriculture there also exist a substantial number of large farms with foreign labor constitutions, which are also characterized by great demands on farm management. In recent decades farmers have invested

heavily in their farms and great steps of growth have been taken. In this regard, increasing competitiveness of enterprises was expected. Subsequently a phase of consolidation is following for the grown farms, in which they have to achieve financial stability. To ensure that the "right things" get done and these things are done right is important to make use of a workable management system in addition to a well-trained farm manager and professional employees (Jack, 2009).

Against this background numerous instruments, such as crop field cards, sow and cow planners or accounting software, have been developed to support the management of farms. But so far these instruments are only insufficiently integrated, so that the operating farm manager must keep a multitude of figures in his or her mind (Paustian et al., 2015). Thus, there is a need for a more comprehensive management tool that provides an overview of all production and management activities on a farm. With the Balanced Scorecard (BSC) a management tool is available that can assist the management of modern, growth-oriented farms by translating farm strategies into operational actions and reviewing the achievement of objectives (Dunn et al., 2006). In addition to traditional financial measures the BSC contains supplementary performance criteria from three further perspectives: markets and customers, internal business processes, and learning and growth.

Kaplan and Norton (1992) introduced the BSC as a planning and management tool for performance measurement first to combine financial measures with qualitative measures as customer loyalty, employee satisfaction and corporate mission. In a second step they show how to transform the BSC from a tool for performance measurement to a tool for creating a strategy-driven company (Kaplan and Norton, 1996). For this step they use four principles, which are the translation of the strategy into operational terms in order to align the organization to the strategy, to make strategy everyone´s everyday job, to introduce strategy as a continual process and to mobilize change through executive leadership (Kaplan and Norton, 2001). Kaplan and Norton (1992) stated that viewing a business from different perspectives helps answering basic questions like:

- How do customers see us? (customer perspective)
- What must we excel at? (internal perspective)
- Can we continue to improve and create value? (learning and growth perspective)
- How do we deal with shareholders? (financial perspective)

In the following years strategy implementation will be one of the important success factors of farms. The BSC is a management tool which can help to link the strategy formulation and implementation into practice. The consistent focus on the vision and strategy helps to target objectives of the farm. The visualization of the vision and strategy can be supported by strategy maps which make the connection between the various goals in the four perspectives visible for the farm manager, employees and stakeholders. Finally the BSC gives an overview about all key business processes in the farm and assists to maintain control by focusing in a few core success indicators.

Purpose of the paper

The adaptation of the BSC to the needs of farm managers has been insufficient so far and there is no information available about the use of key performance indicators for all BSC perspectives by different farm types. In order to close this research gap this paper introduces the concept of an Agricultural Balanced Scorecard for arable farms which takes into account strategies and key performance indicators in the four BSC perspectives that the respondents, farm managers and agricultural consultants, considered most relevant for the operational success of arable farms. So far there are only case studies but no quantitative research dealing with the application of the BSC on agricultural farms. Quantitative research was used in this study to get empirical insights into farm planning and control and adapt the BSC concept to crop farming. The data was collected in a survey and analyzed with the target to evaluate the most important key performance indicators for performance measurement for arable farms. A cluster analysis was conducted to gain information about differences between the evaluated measures, importance of strategies and management needs in different arable farm types. This should lead to more knowledge about the use of key performance indicators for all business areas of crop farming by different farm types.

2 Approaches for implementing the Balanced Scorecard into agriculture and the food sector

The link between business performance and planning in owner managed farms has been recognized for a long time in farm management literature (Riebe and Sundermeier, 1997; Inderhees, 2006; Mußhoff and Hirschauer, 2010, Doluschitz et al., 2011). Therefore, several farm management tools, both traditional and IT-based, have been developed to support planning and performance measurement at the farm level. Management tools that are often used in practice are crop field cards, sow and cow planners and stock management software as individual applications and, for instance, farm data comparison as a basis for comparison with other farms (Schön et al., 2003; Brüggemann, 2004). Presently, the farm data comparison (i.e. benchmarking) is an established tool in Germany to identify weak points of business and farm management and possibilities for improvement. Furthermore, it is used for monitoring farm success. Due to the changing economic environment of the farm business, the analytical procedures exerted to compare farms had to change over time (Riebe and Sundermeier, 1997). Even though German farm data comparisons and other management tools often concentrate on financial measures, there is still no strategic management tool which establishes linkages between financial measures, corporate strategy and operational terms introduced to German agricultural farming sector. This gap can be closed by the BSC.

The success of the BSC is due to the factors underpinning the financial aspects and thus determining the achievement of objectives (Horváth and Kaufmann, 1998). The main elements in the center of the BSC are mission, vision and strategy. The mission statement of a company explains its purpose of existence while the vision statement expresses what a company would like to achieve. The strategy describes the way to achieve the goals in the future and includes long-term directed decisions (Johnson et al., 2006; Kaplan and Norton, 1996). Managers using the BSC have the opportunity to link long-term strategic objectives with short-term actions by introducing a new management process with four steps: 'translating the vision', 'communicating and linking', 'business planning and feedback' as well as 'learning'. In all steps of the process there is the opportunity to design and adapt the elements of the scorecard to the company. The BSC provides a snapshot of where the company has been and in which direction it has to go in the future. Thus, it allows of getting an abstract view of the business to monitor the progress in fulfilling the mission, vision and corporate strategy (Horváth and Kaufmann, 1998). To keep the measurement system cognitively and administratively simple, the set of BSC measures should be limited in number, normally three to seven measures per perspective, with the requirement that the selected performance measures should describe the company´s critical performance variables (Malina and Selto, 2001).

In the international literature only few approaches to the management and use of the BSC in agriculture are described. The first attempts for applying the concept existed in Denmark, Ireland, New Zealand, Ukraine, the UK and the USA (Noell and Lund, 2002; Byrne and Kelly, 2004; Shadbolt et al., 2003; Lissitsa, 2005; Dunn and Etheredge, 2005; Cardemil-Katunaric and Shadbolt, 2006; Dunn et al., 2006; Jack, 2009) . The BSC was applied to various farm sectors including milk, livestock and fruit production. It also was introduced to the meat production chain in Australia and to the food supply chain in Italy (Bryceson and Slaughter, 2009; Bigliardi and Bottani, 2010).

Dunn et al. (2006) described the BSC framework with its core vision as a value-based purpose that delivers strategy to the organization and added two more perspectives to the BSC – lifestyle and natural resources. However, addition of more perspectives was based on the specific needs and characteristics of agriculture from their point of view. Other authors also point out that having only four perspectives is a weakness of the BSC. In this regard, they recommended additional perspectives such as human resources, people, natural resources, lifestyle, supply chain, innovation processes and society (Lissitsa, 2005; Shadbolt, 2007; Haapsalo et al., 2006; Bryceson and Slaughter, 2009). In Figure 1 the adapted BSC to the needs of arable farming is presented. Due to the fact that crops are bulk goods which are traded on markets the customer perspective should be modified to the market perspective.

Figure 1. Balanced Scorecard for Arable Farms– Translating Vision and Strategy to four Perspectives
Source: own presentation modified to Kaplan & Norton (1996)

A benefit from using the BSC approach is that farm managers can observe the interrelationships between their businesses areas and have the opportunity to identify specific action plans for improvement (Dunn et al., 2006). The farm manager gets information about the reviewed farm processes and measures and can assess whether enhancement in one area triggers improvement in another business area. The success of a farm in the future might be affected particular by one component, education for instance. A higher level of knowledge about wheat production may lead to increasing yields and results in increasing financial returns.

Until now the application of the balanced scorecard in agribusiness was merely described in case studies (Shadbolt et al., 2003; Kelly and Byrne, 2004; Lissitsa, 2005; Bryceson and Slaughter, 2009). For example, in Ireland the BSC was discussed in six detailed case studies for milk production and developed for six dairy farms taking into account the local conditions and structures (Byrne and Kelly, 2004). Therefore, there is a clear lack of quantitative information which could provide insights into the management requirements of farm managers and guide the adaptation of the BSC to the specific needs of agriculture.

3 Material and Methods

Since there are no comparable research studies about the use of the BSC in arable farming until now, this study aims to provide first approaches to applicate the BSC in the German crop production. To get more information about relevant aspects for developing BSCs for strategies of farms in the field of crop production, success factors and key performance indicators in the four BSC perspectives that the respondents consider most relevant for the operational success of arable farms were surveyed. During the survey a wide range of statements for each BSC perspective were presented to the respondents and answers measured by using five-point Likert-scales[*]. The questionnaire was adjusted to farmers and farm advisors and was pretested with farmers and experts subjected to the understandability and check user-friendliness before the start of the survey. In a standardized online survey in August 2014 the opinions from 265 farm managers and agricultural consultants were surveyed. The survey consisted of three parts: operational farm information, operating figures and personal information. The concept of the questionnaire was based on theoretical considerations on the BSC concept by Kaplan and Norton (1992; 1996) and adjustments to the agricultural sector, which were presented in the literature review.

Data analysis was carried out by using the software SPSS statistics 22 by the use of univariate, bivariate and multivariate methods (Bühl, 2014). Following the approach of Kaplan and Norton (1992; 1996) to

[*] Likert-scale from 1 = fully agree to 5 = fully disagree

develop a BSC, a cluster analysis based on the visions and strategies of the farms surveyed was conducted to gain information about the differences between the evaluated measures and importance of strategies in arable farms. As a statistical method, the hierarchical cluster analysis developed by Ward was used. Purpose of the cluster analysis was to identify different arable farm business types with regard to their management needs. By using the Ward method all identified cluster are heterogeneous in between but close to the mean value inside the group (Schendera, 2010). For the different farm types the most appropriate indicators in the four BSC perspectives are presented. In order to examine significant differences between the characteristics of the three clusters, mean comparisons were performed by one-way ANOVA to find possible differences between mean values (Backhaus et al., 2011).

4 Results

4.1 Sample description

Data of 265 farm managers and agricultural consultants were surveyed. 90.2 % of the study participants are male and 9.8 % female. Most of the farmers and advisors are from Lower Saxony (51.7 %), Bavaria (16.2 %) and North Rhine-Westphalia (10.2 %). Also named were Schleswig-Holstein (5.3 %), Mecklenburg-West Pomerania (4.2 %) and Saxony-Anhalt (3.4 %). The percentage of participants with a general qualification for university entrance is high (64.5 %), just as well as the university degree (50.9 %) as highest agrarian qualification. Only 5.3 % of the respondents are without any agrarian qualification. The interviewed persons can be differentiated in 14.3 % advisors and 85.7 % farmers, whereby farmers are farm managers, farm successors and hired executive employees. The medium experience in crop production amounts 12.65 years and most of the farmers are farming conventionally (96.5 %) on professional farms (81.5 %). Agricultural business branches besides crop farming are fattening pigs (17.2 %), piglet production (6.2 %), cattle (20.3 %) and dairy production (16.3 %), renewable energy production (22 %), agricultural contractor services (11.9 %) and cultivation of special crops (14.5 %). The medium farm size of all farms amounts 316 ha with a standard deviation of 624 ha with minimum of 5 ha (smallest farm) and maximum farm size of 5,000 ha (biggest farm). The average numbers of employees at the crop farms are 1.5 family workers and 1.7 non-family workers.

4.2 Descriptive results

In the survey farmers and farm advisors were asked about their personnel opinions how they evaluate the importance of the key performance indicators for farm performance measurement for the perspectives finance, market, internal processes and learning and growth. To follow Dunn et al. (2006), the perspectives of the BSC approach were adjusted to the needs of arable farms and though the customer perspective was changed into market perspective. Arable farms have not much contact with individual customers, but they have a lot of exchange with the (world) market in form of crops and basic agricultural inputs. The key performance indicators were selected by literature review and expert advice. The mean values were measured by a Likert-scale with a range from 1 (fully agree) to 5 (fully disagree). In Table 1 the key performance indicators which considered most appropriate by the respondents to monitor farm performance are shown. For each perspective between seven and nine important indicators are presented. These indicators are a starting point for development a BSC for crop farming.

As the most important indicators for the financial perspective the respondents ranked profit margin, direct cost-free performance, farm profit and cash-flow. For the market perspective the farmers and advisors scored the realized market price for crops, the achieved prices for agricultural inputs, the ratio of lease agreements and transport cost to top position. The positive assessment for yield in the internal processes perspective is hardly surprising. With regard to operational processes, plant protection expenditure, fertilizer costs and working-time requirement per ha are ranked highly. To achieve better results in the future, the respondents attributed highest importance to professional development, job satisfaction of employees, leisure family time and time for personal consultation with employees.

Table 1.
Mean values of key performance indicators for crop farming

Perspective	Key performance indicators[†]	MV
Financial perspective	Profit margin	1.77
	Direct cost-free performance	1.87
	Farm profit	1.94
	Cash-flow	2.05
	Changes in equity	2.08
	Liquidity (1^{st},2^{nd} and 3^{rd} grade)	2.15
	Earnings before interest, taxes, depreciation amortization (EBITDA)	2.27
	Return on Investment (ROI)	2.29
Market perspective	Realized market price (crop)	1.56
	Achieved prices for agricultural inputs	1.78
	Ratio of lease agreements	2.14
	Transport costs	2.39
	Storage costs	2.41
	Rate percent of loan capital	2.44
	Ratio of pre-contracts	2.49
	Distance from the market place	2.55
Internal processes perspective	Yield (crop production)	1.61
	Plant protection expenditure	2.09
	Fertilizer costs	2.11
	Working-time requirement in hours per ha	2.18
	Lease expense	2.18
	Quality deduction and premiums	2.37
	Cost of capital	2.39
	Labour costs	2,55
Learning and growth perspective	Professional development	1.55
	Job satisfaction of employees	1.70
	Leisure family time (in hours per week)	1.77
	Time for personal consultation with employees	1.84
	Crop farming consultancy	1.94
	Professional business consultancy	1.95
	Working group (crop farming)	1.99
	Applications for new leases	2.02

Source: own calculations. N = 265.

4.3 Cluster analysis

Prior to the adaptation of the BSC to different farm types with regard to their strategy and vision, the data were analyzed by cluster analysis. According to the concept of Kaplan and Norton who suggest top-down logic in development of a BSC, the variables addressing farmers' visions and strategies were used as cluster-forming variables. All cluster-forming variables fulfil the requirements that are necessary to use a hierarchical cluster analysis: metric scale, normal distribution and low correlations. In a first step the single linkage method was used to identify outliers and anomalies. After the exclusion of outliers a cluster analysis using the Ward method was carried out to find the optimal number of clusters. The clusters are formed by Ward's minimum variance criterion to minimize the within cluster variance and also the elbow-criterion was taken into account in the cluster identification (Brosius, 2011). To examine the validity of the cluster solution a discriminant analysis showed that accuracy of classification is about 85.2 %. The quality of the analysis is according to the requirements mentioned in the literature (Backhaus et al., 2011).

Only valid values of farmers were used for the analysis; in total 223 subjects (N) were counted. All farmers surveyed valuated their attitudes towards visions and strategies, which were the basis of cluster analysis. The following four statements regarding farmers' visions are requested: "I would like to work with modern machinery and follow an intensive, market-focused crop production", "I would like to conserve natural resources and operate sustainably", "I would like to continue the tradition of my family,

[†] Likert-scale from 1 = fully agree to 5 = fully disagree

agriculture is my pleasure", "I have a high propensity to invest in modern technology, land and farm equipment". Additionally several strategy options were used as cluster-building variables. The test candidates had the option to give their evaluation to the strategy options: profit maximization of the company, profit maximization of crop production, decrease of production costs, intensive farming, extensive farming, participation in and optimization of agricultural promotion programs, sustainable business operations, diversification of production, and specialization of production and high quality standards of harvested products.

Three clusters were identified in the ward cluster analysis: cluster 1 "modern farms" (N=98), cluster 2 "extensive and diversified farms" (N=75) and cluster 3 "established farms" (N=50). The empirical cluster analysis has figured out the essential characteristics and preferences of the farmers in relation to the cluster-building variables of vision and strategy variables. The results of the analysis are different, but internally homogeneous clusters. To assess the equality of variances, the cluster variables were tested by Levene test to receive information about homogeneity of variances, resulting that the variances of the formed clusters are equal. This is a prerequisite for mean comparisons with the cluster-building variables by univariate ANOVA using the Scheffé method. In the univariate ANOVA significance levels for the three clusters were tested. In Table 2 the results of ANOVA and multi comparison followed by Scheffé post-hoc test are presented and combined with information about cluster-describing operational parameters to characterize the clusters.

Cluster 1, the "modern farms", is characterized by the highest number of subjects (N=98) and the highest average hectare size (389 ha). The respondents of these groups have the highest approval for the variables `*I would like to work with modern machinery and follow an intensive, market-focused crop production*` and `*I have a high propensity to invest in modern technology, land and farm equipment*`. For these variables significant differences to cluster 2 were observed. Almost all farmers are farming conventional and full-time. This group has the largest number of non-family workers, on average 2.5 family employees, which fit to the highest average farm size. The average time of experience in crop farming is 11 years. Thus, the respondents in this cluster have the shortest experience time with the highest ratio of young adults. The preferred strategies with nearly fully agreement are profit maximization of the farm and crop production as well as sustainable business operations and high standards of harvested products. This cluster is particularly differentiated to the other clusters by the variables `*intensive production*` and `*decrease of production costs*`. This cluster can be described as consisting of modern arable farms with intensive production, modern machinery, strong growth-orientation and profit maximization and led by younger professionals.

Table 2.
Characterization of the clusters by vision and strategy variables and cluster describing operational parameters

	Cluster 1 „modern farms“	**Cluster 2 „extensive and diversified farms“**	**Cluster 3 „established farms“**	**Total**
N = number of objectives	98	75	50	223
	MV	MV	MV	MV
I would like to work with modern machinery and follow an intensive, market-focused crop production.[‡]	1.55 [b]	2.33 [ac]	1.76 [b]	1.86
I would like to conserve natural resources and operate sustainable.	1.52	1.80	1.42	1.59
I would like to continue the tradition of my family, agriculture is my pleasure.	1.66 [b]	2.12 [ac]	1.40 [b]	1.76
I have a high propensity to invest in modern technology, land and farm equipment.	2.14 [b]	2.89 [a]	2.50	2.48
profit maximization of the company	1.27	1.48	1.46	1.38
profit maximization of crop production	1.59 [c]	1.87 [c]	2.48 [ab]	1.88
Decrease of production costs	1.76 [bc]	2.05 [ac]	2.74 [ab]	2.08
Intensive farming	1.90 [bc]	2.65 [a]	2.30 [a]	2.24
Extensive farming	3.79 [b]	2.93 [ac]	4.08 [b]	3.57
Participation in and optimization of agricultural promotion programs	2.36 [c]	2.56 [c]	3.68 [ab]	2.72
Sustainable business operations	1.52	1.59	1.60	1.56
Diversification of production	2.59 [b]	2.15 [ac]	2.80 [b]	2.49
Specialization of production	2.28 [b]	3.21 [ac]	2.62 [b]	2.67
High quality standards of harvested products	1.45 [b]	1.83 [a]	1.72	1.64
Farm size (in ha) n. s.	389	268	243	316
Ground points (number) n. s.	56	54	62	57
Land management[§] n. s.	1.01	1.07	1.04	1.04
Employment form[**]	1.13 [c]	1.13 [c]	1.34 [ab]	1.18
Family workers (number)	1.5	1.6	1.3	1.5
Non-family farm workers (number)	2.5	1.2	1.1	1.7
Ø experience in crop farming (years) n. s.	11.00	13.28	14.12	12.47

Source: own calculations; Cluster analysis (method Ward); ANOVA analysis with post-hoc test by Scheffé method (0.05); letters describe significance between cluster (e.g. “a” for significant difference from cluster 2 to cluster 1); n. s. = not significant; N = 223.

The main points for cluster 2 are extensive production and diversification. These strategy variables have the highest rating by cluster 2 and represent the main strategies of the farms belonging to this cluster. Other vision and strategy variables were rated significantly lower than in the other farm groups, e. g. `*I would like to work with modern machinery and follow an intensive*`, `*market-focused crop production*` and `*I have a high propensity to invest in modern technology*`, `*land and farm equipment*`. Cluster 2 includes farms with an average farm size of 268 ha. The farmers in this group work mostly full-time as farmers and they employ on average 1.2 non-family farm workers. The average experience in crop farming is with a mean of 13.28 years a bit longer than in cluster 1.

Cluster 3 is named “established farms” due to an on average long experience in crop production of about 14.12 years. In this cluster there are significantly more part-time farmers included and they have the lowest number of family (1.3) and non-family farm workers (1.1). Another significant difference to the

[‡] Likert-scale from 1 = fully agree to 5 = fully disagree
[§] Land management: 1 = conventional; 2 = organic; 3 = in conversion to organic
[**] Employment form: 1 = full-time farming; 2 = part-time farming

other two farm groups is the low approval to the strategy variable `*participation in and optimization of agricultural promotion programs*`. Most of the cluster-forming variables of the "established farms" are following the mean values of the "modern farms" cluster. The "established farms" are traditional oriented and strongly agree with `*I would like to continue the tradition of my family*`, `*agriculture is my pleasure*`. This is significantly different from cluster 2. The average farm size of cluster 3 is on average 243 ha.

In Table 3 significant differences of mean comparisons of the perceived relevance of key performance indicators in the four BSC perspectives are shown.

Table 3.
Significant differences between clusters

	Cluster 1 „modern farms"	**Cluster 2 „extensive and diversified farms"**	**Cluster 3 „established farms"**	**Total**
N = number of objectives	98	75	50	223
	MV	MV	MV	MV
Financial perspective				
Return on Investment (ROI) [††]	2.17 [c]	2.19 [c]	2.64 [ab]	2.28
Return on Equity (ROE) [7]	2.24 [c]	2.16 [c]	2.76 [ab]	2.33
Return on Sales [7]	2.45 [c]	2.44 [c]	2.84 [ab]	2.53
Market perspective				
Discount by agricultural trade [7]	2.60 [bc]	2.96 [a]	3.08 [a]	2.83
Interest rate for capital [7]	2.12 [bc]	2.56 [a]	2.70 [a]	2.40
Ratio of lease agreements [7]	1.97 [c]	2.08	2.48 [a]	2.12
Internal processes perspective				
Yield (crop production)	1.53 [b]	1.77 [a]	1.76	1.66
Seed expenditure	2.63	2.56 [c]	2.98 [b]	2.69
Fertilizer costs	2.05 [c]	2.01 [c]	2.42 [ab]	2.12
Costs of lubricants and motor fuels	2.52 [c]	2.83	2.94 [a]	2.72
Administrative costs	2.65 [bc]	3.03 [a]	3.12 [a]	2.88
Cost of capital	2.08 [bc]	2.68 [a]	2.44 [a]	2.36
Rate on equity	2.44 [c]	2.65	2.92 [a]	2.62
Learning and growth perspective				
Professional business consultancy	1.91 [c]	1.95	2.28 [a]	2.00
Crop farming consultancy	1.84 [c]	2.03	2.18 [a]	1.98
Working group (crop farming)	1.91 [c]	2.01	2.28 [a]	2.03
Social commitment	2.52 [b]	2.15 [a]	2.52	2.39
Leisure family time (in hours per week)	1.89 [b]	1.56 [a]	1.86	1.77

Source: own calculations, ANOVA analysis with post-hoc test by Scheffé (0.05), letters describe significance between cluster (e.g. "a" for significant difference from cluster 2 to cluster 1); N = 223.

The "modern farms" differ from the "established farms" by the indicators `ratio of lease agreements`, `costs of lubricants and motor fuel`, `fertilizer costs`, `rate on equity`, `professional business and crop farming consultancy` and `importance of working groups`. Clusters 1 and 2 do not differ strongly. The "extensive and diversified farms" also differ from the "established farms" in the financial perspective as well as in the internal processes perspective. With regard to some other indicators, this cluster differs from the "modern farms". Differences occur with regard to `discount by agricultural trade`, `interest rate for capital`, `yield`, `administrative costs`, `costs of capital` and in the learning and growth perspective in the indicators `social commitment` and `leisure family time`.

It becomes apparent by this mean comparison that the strategic management focus of the clusters is different. This has to be taken into account when developing BSCs for crop farms. As a main result it can

[††] Likert-scale from 1 = fully agree to 5 = fully disagree

be mentioned that the specific demands of different crop farm types lead to different weights attributed to key performance indicators. The variables with significant differences, shown in table 3, cannot be used equally for developing BSCs for all crop farm types. For example leisure family time and social commitment is highly important for the "extensive and diversified farm", but these indicators must not necessarily be taken into consideration by developing a BSC for the other farm types.

5 Discussion and Conclusions

The general goal of this study was to show that the BSC concept proposed by Kaplan and Norton can be adapted to arable farms. The empirical results show that the respondents in fact consider performance measures from all four BSC perspectives relevant for farm management. Thus, the general idea of the BSC concept, i.e. performance measurement through a combination of easy to measure and output oriented lagging indicators and input oriented and hard to measure but easy to influence leading indicators (Horváth and Kaufmann, 1998), is widely shared in the farming sector.

The BSC is an interesting management tool for crop farms which can help to provide an overview over all business processes and to achieve the individual farm objectives. Despite this general applicability, the BSC has to be adapted individually to the local conditions, resources, and farm manager and employees characteristics (Kaplan and Norton, 1992). This is underpinned by the results of the cluster analysis which highlight the need of adaptation to different farm strategy types. The cluster analysis shows differences with regard to the implementation of visions, strategies and objectives between three different farm types. Thus, a standardized BSC may not work equally well for all types of arable farms. The examples presented in this study can be used to assist the creation of individual BSCs for arable farms which take into account individual needs and reflect the different operating figures farms choose for performance measurement. The empirical results also indicate that the differences, which have to be taken into account, are mainly influenced by farm size, farmers' experience in crop production, local conditions and expectations for the future. This leads to the conclusion that all farm types have different visions and strategies in consequence of structural and personal specifics.

The developed BSC with vision, strategy and key performance indicators is not the end. The linkages of strategic goals between the perspectives of BSC and the general strategy have to be figured out by strategy maps (Kaplan and Norton, 2004). That would help the farm managers and employees to understand the relationships of strategic goals and show if the BSC can work in practice. Strategy maps are developed on the basis of the calculated relevance of indicators in the four BSC perspectives for each cluster. By the selection of targets and indicators for the strategy maps logical relationships and practical applicability can be considered. Nevertheless, not in all cases those indicators which are chosen and considered are most important for the business success of farms. The verification of strategies and indicators by the use of strategy maps should be part of further research.

However, the BSC as a flexible management tool needs regular care. Its benefits for performance measurement and farm planning require continuous adaptation to the operational specifications of the farm. This advancement leads to constant examination of the chosen strategies. The development of a BSC for their farms can help farm managers to link current actions to future goals. Adaptation of measures to achieve the goals or adaptation of the objectives of the strategy to achieve better farm performance should be the result of the review processes. This can promote the achievement of long-term goals and optimization of business processes.

Challenges by introducing the BSC to crop farming are the recurrent adaptation to operational farm requirements, integration of a review routine in the farm workaday life and investment in the time-consuming development process especially at the beginning. Due to these obstacles, the support of professional agricultural advice could be useful, particularly during the introduction and development of a farm's BSC. Formulation of vision and strategy would be the major challenge for the farm manager. Afterwards updating of objectives, indicators and measures is the main sticking point for a successful BSC implementation. Besides, the acceptance of the employees is even better, if the farm manager communicates the benefits of the BSC.

Therefore, the conclusion can be formulated that the BSC is an adaptable and flexible management instrument for arable farms, but requires further adaptations to the peculiarities of the farming business and needs to be tested in practice. The presented rating of indicators is a starting point to implement the BSC. Managerial implications for adaptation of the BSC concept are to start with formulating farm vision and strategies for crop farming. Long-term as well as short-term operational goals must be specified. In the next step the key performance indicators which can lead to these goals have to be found and afterwards the strategic link has to be verified by strategy maps. From this point on, the farm BSC has to

be used in practice, should be reviewed regularly and must be adapted to changing situations, for instance with regard to the focus of farm activities.

Additional research is required to get more information about the use of key performance indicators in several agricultural business branches, e. g. dairy, piglet, pig, cattle, and renewable energy production, agricultural contractor services and cultivation of special crops. This research would help that the BSC concept is better tailored to the needs and specific requirements of various farming businesses. Further research should also address diversified agricultural holdings which include various farm and non-farm businesses.

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