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A Causal Model of Consumer-Based Brand Equity

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Abstract. Branding literature suggests that consumer-based brand equity (CBBE) is a multidimensional construct. Starting from this approach and developing a conceptual multidimensional model, this study finds that CBBE can be best modelled with a two-dimensional structure and claims that it achieves this result by choosing the theoretically based causal specification. On the contrary, with reflective specification, one will be able to fit almost any valid construct because of the halo effect and common method bias. In the final model, Trust (in quality) and Advantage are causing the second-order Brand Equity. The two-dimensional brand equity is an intuitive model easy to interpret and easy to measure, which thus may be a much more attractive means for the management as well.

Keywords: brand equity, structural equation modelling, causal measurement models
JEL Classification: C3,M31

1. Introduction

The present paper focuses on measuring consumer-based brand equity defined by Aaker (1991) as a set of brand assets or liabilities that add to or subtract from the value provided by a product or service. The empirical research based on Aaker's (1991) model has significantly determined the approach of the present paper.

The concept of brand equity became popular at the beginning of the eighties mainly as an agency-based measure of marketing efficiency (Interbrand, Coopers and Lybrand, Arthur Young Australia). After the conference of the Marketing Science Institute in 1988, the concept gained quick academic acceptance (Farquhar, 1989; Aaker 1991, 1993; Keller, 1993).

Consumer-based brand equity research predominantly uses structural equations for estimation (Erdem & Swait, 1998; Yoo & Donthu, 2000; Vázquez et al., 2002; Netemeyer et al., 2004; Martensen & Gronholdt, 2004; Erdem et al., 2006; Jensen & Klastrup, 2008; Chau & Ho, 2008; Boo et al., 2009; Atilgan et al., 2009; Kim & Hyun, 2010). Some studies do not operationalize brand equity but only its dimensions (Vázquez et al., 2002; Boo et al., 2009; Netemeyer et al., 2004), while others do not estimate brand equity as a second-order latent variable, but they include the construct as a dependent variable (Martensen & Gronholdt, 2004; Kim & Hyun, 2010). Some studies estimate the causal measurement model in isolation and do not report on appropriate fit indicators (Martensen & Gronholdt, 2004). Atilgan et al. (2009) operationalize brand equity as a latent variable, but they estimate only the CFA (Confirmatory Factor Analysis) model and do not provide information about structural relationships (but they do provide the cultural validation of their model). In general, no author argues about the reflective, respectively the formative or causal specification they choose in designing their consumer-based brand equity model. This could be attributed to the fact that the academic debate on causal vs. reflective specification is relatively new.

Several empirical models employ the causal specification of consumer-based brand equity without arguing about the chosen specification. Martensen and Gronholdt (2004) specify consumer-based brand equity in a causal measurement model; however, they do not provide parameter results and goodness-of-fit indices of estimation, and they estimate the model in PLS (Partial Least Square), similarly to Jensen and Klastrup (2008), who develop their model for business to business markets. Baldauf et al. (2009) specify brand equity as a second-order construct, but they measure brand equity on the level of retailers. This study estimates a second-order factor model in covariance-based SEM (Structural Equation Model – Amos), while the significant majority of the studies estimate second-order factor models in PLS as Diamantopoulos, Riefler, and Roth (2008) present them.

Keller's conceptual models (1993, 2003) and the articles by Lehman et al. (2008), Vazquez et al. (2002), and Martensen and Gronholdt (2004) suggest that consumer-based brand equity is a multidimensional concept. Lehman et al.'s (2008) article measures 27 concepts, and then reduces them to six factors; Vazques et al. (2002) suggest 8, Martensen and Gornholdt (2004) and Keller (2003) suggest 6 dimensions.

The initial model of this paper is based on the conceptual model of Aaker (1991, 1993) as other important brand equity models; therefore, our model shows similarities to these empirical models, especially to the Yoo and Donthu (2000) model. Our model differs from the other empirical models as it tries to overcome the listed shortcomings; it concretely differs from the Yoo and Donthu (2000) model in specifying brand equity as a second-order latent variable, and models

its consequences. An important characteristic of our model is that we estimate it in a covariance-based SEM, not in the more convenient PLS.

The remainder of this paper is structured as follows. The next section presents the initial model of this study, the third section deals with the specification-related questions of our model, section four presents the methodology employed, section five presents the results, and section six discusses.

2. The Initial Second-Order Model of Consumer-Based Brand Equity

This study re-interprets the consumer-based brand equity concept by asking the question which are those brand-related concepts that can enter an associative structure where they are simultaneously influencing (causing) something.

The study modifies the initial structure of the Aaker (1991) model after re-evaluating the empirical studies based on Aaker's (1991) conceptual model and the multidimensional character of Keller's (1993) conceptual model. The conceptual development of the consumer-based brand equity model of this paper differs from the empirical models based on Aaker's (1991) model in some important points. This study does not define brand-related associations as one concept but includes associations as separate concepts (Uniqueness, Trust, etc.), thus making possible a more detailed assessment of brand-related associations. Further on, the study includes in the model as specific associations the dimensions of differentiation (Advantage and Uniqueness). In spite of the theoretical importance attributed to it (Aaker, 1996; the American Marketing Association's definition of brand; Bauer & Berács, 2006), apart from a few exceptions (Martensen & Gronholdt, 2004; Young and Rubicam's Brand Asset Valuator), differentiation is not present in CBBE models.

The present model endeavours to take into account the business reality that changes as a consequence of the economic crisis and the spreading of social networks, and it includes the dimension of trust in the initial model. Trust has become an essential factor due to the increasing consumer consciousness, availability of quality-related information; on the other hand, the signalling theory states that the success of brand building significantly depends on the extent to which consumers trust the communication of a brand (Erdem & Swait, 1998).

The empirical research (Yoo & Donthu, 2000; Washburn & Planck, 2002; Chau & Ho, 2008; Atilgan et al., 2009; Kim & Hyun, 2010) includes four components of the Aaker (1991) model, namely: Perceived Quality, Loyalty, Awareness, and Associations.

Unlike earlier practice, this study interprets Loyalty similarly to Erdem and Swait (1998), as the consequence of brand equity. To measure Loyalty, following the direction Aaker (1996) indicates, the study uses scale items explicitly referring

to purchase decisions. In the case of such operationalization of loyalty though, the authors do not find it acceptable that Loyalty explains, through its effect on Brand Equity, a consequence of Brand Equity such as Purchase Intention.

The study reinterprets the three Aaker dimensions, following Aaker's (1996) instructions, among others, as follows. Awareness concretely refers to the brand node existing in the consumer's mind; every other brand-related concept qualifies as an association, and since everything that connects with some strength to a brand name representing the node in the association network is an association (Keller 1993).

Consequently, the conceptual model of this study incorporates Awareness and brand-name-related associations such as Uniqueness, Advantage, Perceived Quality, Activity, and Trust.

The following sections present in detail the hypothesized dimensions of the initial model.

2.1. Awareness

Consumers are more likely to select well-known brands from the consideration set (Hoyer & Brown, 1990; Leong 1993), and the consumers who choose a brand with high awareness consider fewer alternatives and more rarely choose the best quality brands (Hoyer & Brown, 1990). The results of the classical articles of Hoyer (1984) and Hoyer and Brown (1990) were repeatable on other, greater samples (MacDonald & Sharp, 2000; Huang & Sarigöllü, 2012), and Leong (1993) confirms their cultural validity. The awareness dimension does not enter the final model in some cases (Atilgan et al., 2009) nor does this dimension fit as an independent one (Yoo & Donthu, 2001; Kim & Hyun, 2010), and from the analysed thirteen empirical models only one accepts awareness as an independent dimension of the final model (Boo et al., 2009). Given the importance of awareness in the conceptual models (Aaker, 1991; Keller, 1993), the authors still consider it important to introduce awareness into the initial model to find out how this dimension fits the causal structure of the model.

2.2. Uniqueness

This study operationalizes uniqueness and advantage as the subdimensions of a more comprehensive differentiation. Differentiation means that a brand is able to provide more in the case of a certain characteristic than a concurrent one in such a way that consumers' sensitivity and expectation towards other characteristics decrease, due to which a brand can reduce costs (Sharp & Dawes, 2001). Uniqueness measures merely distinctness since there are consumers who, to enhance their consumer status, distinguish themselves from others by possessing a brand.

2.3. Advantage

The advantage dimension measures the extent to which a brand can differentiate itself in such a way that it offers real benefits compared to its competitors. The advantage dimension is part of the agency-based BrandZ model and it is also a dimension of the second-order comparative advantage in the brand performance model (Lehman et al., 2008).

The operationalization of Advantage makes this dimension similar to the conceptualization of the perceived value that Zeithalm (1988) formulates as "value is whatever I want in a product".

2.4. Perceived Quality

Perceived quality is one of the key dimensions of consumer-based brand equity (Aaker, 1996; Netemeyer et al., 2004); it is present in a great number of consumer-based brand equity models (Yoo&Donthu, 2001; Netemeyer et al., 2003; Erdem & Swait, 1998; Erdem et al., 2006; Atilgan et al., 2009; Boo et al., 2009; Kim & Hyun, 2010) and constitutes the dimension of Aaker's (1991) conceptual brand equity model.

Perceived quality adds value to the product by creating motivation to buy, making price premium application possible, and differentiating the brand. Companies characterized by high market orientation invest in quality development instead of trying to achieve a better financial performance with price cuts (Hooley et al., 2000). The research of Jacobson and Aaker (1987) on 3,000 strategic business units from PIMS database finds perceived quality the most important factor influencing returns. Managers indicated perceived quality as the most important source of competitive advantages (Aaker, 1989).

2.5. Activity

Social communities, through the spectacular spreading of community networks (Facebook, Twitter, etc.) and user-generated content (blog, forums), have a significant impact on judging brands and spreading brand-related information (Patterson, 2012), and they increase the instability of the market structure (Sengupta & Greetham, 2010). In Peres et al. (2010), the re-definition of innovation diffusion is necessary to stress the central role of social relations in the innovation diffusion model. In the present, the initial model activity measures the consumers' willingness to share information about a brand, to treat it as part of their everyday life (Lehman et al., 2008).

2.6. Trust

Trust is one of the most important concepts related to a brand (Delgado & Munuera, 2005; Delgado et al., 2003; Chaudhuri & Holbrook, 2001). Trust is a component of several consumer-based brand equity measures (Martensen & Gronholdt, 2004; Christodoulides et al., 2006; Atilgan et al., 2009; Research International's Equity Engine).[1] Trust is also a component of credibility that plays a central role in Erdem and Swait's (1998) and Erdem et al.'s (2006) CBBE model. When the number of accessible brands grows at a spectacular pace on the market and more low-quality products appear increasingly, trust in a brand is becoming one of the most important factors of consumer-based brand equity. Trust measures a brand's perceived ability to fulfil its offers; thus, a reliable brand does not necessarily provide high quality, but it provides the quality promises.

2.7. Purchase Intention

In the case of brands with high brand equity, this study expects higher willingness to purchase, assuming that high brand equity positively influences purchase intent (Laroche et al., 1996; Cobb-Walgreen et al., 1995; Christodoulides et al., 2006). In their meta-analysis of brand equity, Agarwal and Rao (1996) mark purchase intention as a brand equity measure of high priority, but they do not interpret it as a consequence of brand equity.

2.8. Low Search Cost

The economic literature discusses the reduced search costs as one of the most important advantages provided by a brand (Ramello, 2006). For instance, the rise of the relative cost of time increases the demand for the well-known national brands (Pashigian & Bowen, 1994). From the viewpoint of the transaction costs theory, the impact of brand equity on consumer decisions increases in the case of product categories with high transaction costs (Fernández-Barcala & González-Díaz, 2006). Under the conditions of information asymmetry, the importance of a brand grows (Akerlof, 1970) since by its ability to signal quality the brand reduces information asymmetry, thus reducing search costs and perceived risk (Erdem & Swait, 1998; Erdem et al., 2006; Christodoulides et al., 2006; Tsao et al., 2006).

1 After Research International has merged into TNS, this model was withdrawn from the market.

3. The Problem of Specification

The debate on causal vs. reflective models is rather new; consequently, the problem of specification of brand equity models was never an issue in brand equity research, and the majority of models use reflective specification. The present paper operationalizes consumer-based brand equity in a causal measurement model.

When searching for the answer as to whether measure consumer-based brand equity with causal or reflective indicators, we do not want to answer the question what consumer-based brand equity is like. Consumer-based brand equity cannot be qualified as either reflective or causal in itself.

We consider that the theoretical and methodological arguments favour causal measurement.

The substantive theoretical formulations essential from the viewpoint of the causal specification of consumer-based brand equity are:

– Brand adds value to the product (Farquhar, 1989; Achenbaum, 1993).

– Consumer-based brand equity is the concept measuring the brand's ability to add value to a product.

– The totality of intangible brand assets (Aaker, 1991).

There are also empirical models that employ the causal specification of brand equity without arguing about the chosen specification (Yoo & Donthu, 2000; Martensen & Gronholdt, 2004; Jensen & Klastrup, 2009; Netemeyer et al., 2004).

The methodology used determines the way we specify the concepts of our model. The first-order latent variables (the dimensions of brand equity) are causing the first-order CBBE. The study estimates the first-order latent variables (dimensions of the CBBE) in reflective measurement models.

In survey-based data collection, we measure latent concepts by asking the interviewees about brand-related associations already present in their mind. When the respondents answer questions related to benefits or perceived quality, their already existent ideas about the benefits and quality will manifest. In this case, the only suitable method for measuring consumer-based brand equity dimensions is measuring with reflective indicators.

Consumer-based brand equity is a theoretical term; thus, consumers do not have already existing ideas about this concept, and consequently CBBE can have no reflections. The substantive formulations essential from the viewpoint of the causal specification of consumer-based brand equity: brand adds value to the product (Farquhar, 1989; Achenbaum, 1993), brand equity is defined as the totality of intangible brand assets (Aaker, 1991). Consequently, theory regards brand equity as something that comes into being due to the associations linked to the brand name.

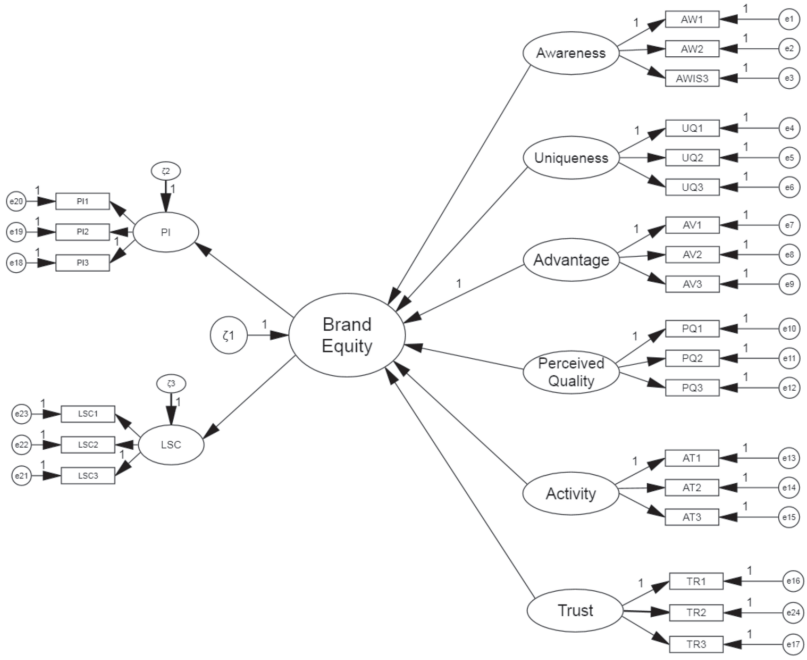
This study distinguishes causal models from composite (formative) as well as reflective models. To the proposal of Bollen (2011), we will try to avoid the

use of the formative notion because it has often been used in the literature to denote (causal) measurement models with real latent variable and (composite) measurement models as well. There are important differences between these concepts. In the case of reflective models, the indicators are the reflections of the latent variable, while in the case of causal models the latent variable is determined by the indicators. In the case of composite (formative) measurement models, a composite (and not a latent) variable is determined by the indicators. In causal measurement, a disturbance term is estimated at the level of the latent variable, which is not the case in composite model estimation.

To estimate causal models with latent variable, estimators (maximum likelihood by default) assured by covariance-based software (Amos, EQS, Lisrel) are suitable, while a popular way to estimate the composite measurement models is PLS (Smart PLS).

The causal measurement model presumes the following relations:

Where $i^{th}$is the causal indicator, the parameter measures the direct effect of the i^{th} indicator on the latent variable, while the disturbance term comprises the variance not captured by the indicators (Diamantopoulos, Riefler, and Roth 2008). There is no correlation between the disturbance term and the indicators of the latent variable (cov ()=0).



Source: own design

Figure 1. *The initial model of the causally measured brand equity*

Illustrating brand equity within a structural equation gives us the opportunity to model consumer-based brand equity together with its sources and consequences. In the model above, the first-order latent variables freely correlate, but the covariance arrows are not represented. The six reflectively measured dimensions cause brand equity, which determines its two consequences: Purchase Intention (PI) and Low Search Cost (LS).

Some important considerations determine the conceptual development of this study. The consumer-based brand equity model has to be a useful tool for management, and brand equity dimensions have to be under the control of management. For example, coherent managerial decisions can build trust. Brand equity measure has to be independent from industry and valid at high abstraction level. It follows from the foregoing that measurement applies to corporate brands, umbrella brands, or product brands rather than on specific product models.

4. Methodology

Structural equation modelling makes possible the application of numerous analysis techniques together, which are built on the general linear model (GLM) (Ullman, 2006). Continuous and discrete independent variables as well as continuous and discrete dependent ones can be built into this model; at the same time, the observed as well as latent variables can also be included and their cause-effect relationships can also be analysed within the same model.

The model has two important parts: the measurement model and the structural model (Tomarken & Waller, 2003). In strict terms, the measurement model is a confirmatory factor analysis model (Garson, 2011), in which the relationship between the latent variables and indicators (observed variables) are modelled and the goodness-of-fit is analysed. In fact, we do not make a further step in building a model until the validity of our measurement model is fulfilled. The measurement model evaluates convergent and discriminant validity, while the structural model assures the evaluation of the theoretical validity (Schumacker & Lomax, 2010).

In structural equation modelling, we also have the possibility to analyse the goodness-of-fit of the two components: the measurement model and the path model separately. One of McDonald and Ho's (2002) most important methodological conclusions is that the goodness-of-fit of the structural equation model is not acceptable if the goodness-of-fit of the two component models is not fulfilled. More precisely, according to the two-step method suggested by them, a model can be regarded as acceptable if the measurement model is fitted first and the path model is fitted next.

4.1. Scale Development, Data Collection, and Sample

Starting from the empirical research based on Aaker's (1991, 1996) model, empirical findings, and the initial model of this study, the authors generated a number of 66 scale items, adapting the majority of the items from other studies (Lehmann et al., 2008; Erdem & Swait, 2006) and formulating some new ones.

The authors presumed that everyone is highly familiar with the selected mobile phone product category, and they selected three mobile phone brands (Nokia, Samsung, and iPhone) as stimuli, mostly because everybody has the possibility to easily get in contact with and experience several mobile phone brands, and consequently give more relevant answers about different brands. At the time of the data collection, the market leader was Nokia and the second biggest brand was Samsung. Despite the presumption that sample members have moderate knowledge or have no experience with iPhone, this brand also enters the study with the scope of testing the possibility of brand measurement when experience is low or is missing.

The questionnaire was carried out with the help of two online survey providers (SurveyMethods, Zoomerang). We sent questionnaires to 395 people's email box, but actually more people received them. The questionnaires were passed to the respondents in three forms. The preferred one was a link sent in a personalized electronic letter following which the addressee could fill in the questionnaire. For security reasons, we did not make it possible to fill in the questionnaire twice from a link sent out to an email. The second form of polling was sending a direct link to people who had agreed before to fill in the questionnaire. In this case, filling in the questionnaire was also limited to one computer, or more precisely only one questionnaire could be filled in from one IP address. The third form of polling was made personally. It was used mostly in the case of those people over forty or fifty who had agreed to fill in the questionnaire but balked at the electronic fill-in or the use of the Internet. The response rate in the case of the questionnaires sent to email addresses can be estimated to 60%.

The analysis starts with 421 observations, coming from a Romanian quota sampling. During the analyses of the missing data, we eliminate the observations with more than 30% missing data, and as missing data does not qualify as MCAR (Missing Completely at Random) the author uses Direct ML estimation in Amos to impute 3.7% of missing data.

We used quota sampling based on gender and age. Data referring to the statistical population were downloaded from the data service provider (Tempo) of the National Institute of Statistics of Romania (www.insse.ro). After deleting outliers and observations with a large proportion of missing data, 332 observations were included into the sample, serving as a starting point for the analyses. But since we deleted the outliers and the observations with missing data earlier, the

proportion of the 15–19 age category significantly decreased to such an extent that we should have used a quadruple factor in applying the weights. The decrease of this age-group in the sample is explained by the fact that in comparison to the other respondents understanding and answering the questions caused difficulties to its members. After deleting the 15–19-year-olds, our sample decreased to 315. *Table 1* illustrates the distribution of the sample according to age and gender. Based on this distribution, we weighted our sample to match the distribution of the population.

Table 1.*Weighting data according to gender and age*

Age	Gender	n %
20–29	Man	13.33
20–29	Woman	25.08
30–39	Man	13.29
30–39	Woman	23.73
40–49	Man	5.06
40–49	Woman	7.28
50–59	Man	6.96
50–59	Woman	5.06
Total		100

Source: own calculations

Because weighted data files are not supported by Amos, we generated a correlation matrix of the measured variables of the model and used this matrix as an input for our structural model.

4.2. Analyses

The research design does not presume any experience of the interviewees with the specific brand but presupposes experience with the product category. In assessing a brand, consumers have two great sources to rely on: abstract information originating in the brand name and the one that relates to detailed product attributes (Dillon et al., 2001; Tafani et al., 2004; Betts & Taran, 2004; Raggio & Leone, 2006; Boatwright et al., 2008). This study considers experience-based data best for building the model; consequently, the assessment of causal specification uses Nokia data (almost 60% from the sample owns Nokia and 16.5% has Nokia as a second mobile, against 16.9% of Samsung and 1.7% of iPhone). Multicollinearity is not likely to pose estimation problems as the maximum VIF (Variance Inflation Factor) value of measured variables is 3.68.

The first step in the search for the suitable causal specifications is the assessment of the measurement model. During this process, we drop several indicators from

the analysis because of low weight, low significance, or low explained variance. Fit indicators of the six-factor CFA (Nokia) do not represent an impressive fit (TLI 0.83, CFI 0.85, RMSEA 0.101); after the elimination of the indicators of Awareness with unacceptably low weight (0.29, 0.48), the model fit got better (TLI 0.83, CFI 0.915, RMSEA 0.82).

The high correlation between Trust and Perceived Quality (0.95) indicates the lack of discriminant validity, suggesting that the two dimensions measure the same thing in fact. After an analysis of the problem, the study formulates the following conclusion. The respondents use their trust in quality as a proxy in order to answer the questions related to perceived quality; they are able to respond the quality-related questions only by quickly examining how much trust they feel in the brand as the questions of quality confuse them.

Despite the fact that Awareness is part of conceptual models, it does not enter the final model of this study. According to the conceptual definition, awareness refers directly to the node in the associative network that stores information related to the brand name. Awareness could not be seen as an association that is linked to the brand node, but something that indicates the presence of this brand node.

The low factor loadings and non-significant path estimates also suggest that the Awareness dimension has to be excluded from the model. Independent fit causes problems in some other researches (Yoo & Donthu, 2001), while others exclude this dimension from the final model as well (Atilgan et al., 2009). The explanation of the phenomenon is that, owing to the great awareness of brand names, the variables get so biased (extreme skew and kurtosis) that fit with the help of ML is not possible.

Activity, a behavioural construct, is part of the initial model even though the conceptual requirements demand clear differentiation of attitudinal constructs from behavioural ones. The authors conceptualized the dimensions (antecedents) of the focal construct as attitudinal constructs and the consequences as behavioural constructs; consequently, the authors introduced the Activity dimension wrongly in the initial model. On the other hand, the Activity dimension has almost no explanatory power (standardized estimate: 0.04), and its effect on Brand equity is implicitly not significant; as a consequence, it has to be eliminated from the model.

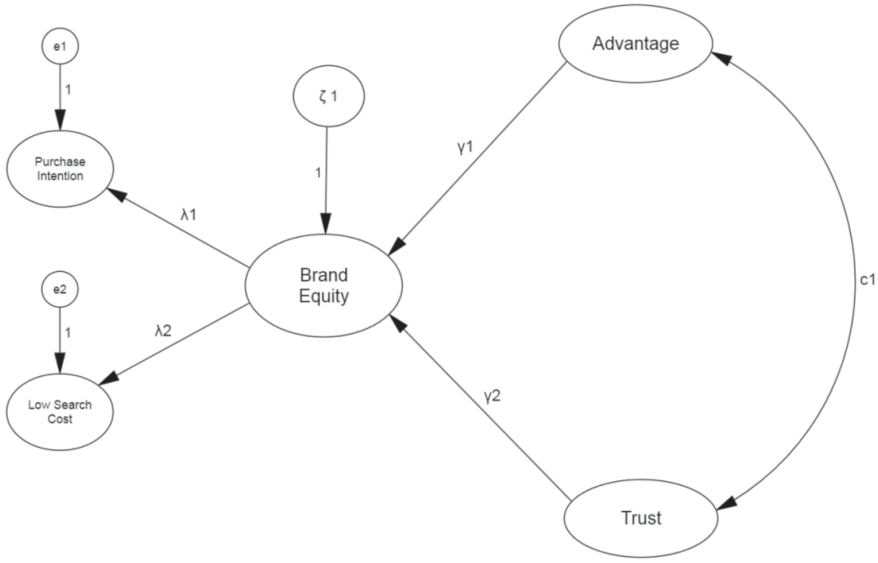
Interpretation of the Uniqueness dimension at a high abstraction level proved to be problematic. For example, the statement that the Nokia brand is unique is difficult to interpret (as it has both really unique and everyday models). This could be one of the main reasons that the Uniqueness dimension has no significant explanatory power and its indicators do not load significantly onto a more general Differentiation construct either. For theoretical and methodological reasons, the authors also eliminated the indicators of Uniqueness.

As a final result, a two-dimensional model is accepted, in which the two dimensions of the consumer-based brand equity (Trust (in quality) and

Advantage) determine the consumer-based brand equity, explaining more than 70% of variance; and consumer-based brand equity has a positive effect on its two consequences, namely purchase intention and low search cost.

5. Results

The model below (*Figure 2*) illustrates the final model. The two-dimensional structure will make measurement simple and economical, thus being an intuitive solution for management.



Source: own design

Figure 2. *The model of the causally measured brand equity*

Advantage and Trust (in quality) are exogenous variables; therefore, the model does not estimate error at their level and they are allowed to correlate freely. In the case of Purchase Intention and Low Search Cost, the model estimates the disturbance term which corresponds to the variance unexplained by Brand Equity as well as it also estimates measurement errors at the level of the indicators. The disturbance term at the brand equity level draws a clear picture of the extent to which the two dimensions explain the variance of the central concept. *Table 2* provides results from the assessment of overall fit for the three mobile phone brands. In the case of Nokia, the goodness-of-fit indicators are excellent. The TLI and CFI exceed the conservative 0.95 boundary as well, the relative chi-square corresponds to the requirement that Hair et al. (2009) formulate, the RMSEA

value is good, and SRMR qualifies as outstanding (0.034). In the case of the other two brands, the baseline comparison indices above the 0.9 cut-off value represent a good fit; only the RMSEA values indicate a lower fit in comparison to Nokia. In both cases (Samsung, iPhone), the 0.05 value of the SRMR also shows a good fit.

Table 2. *Fit statistics*

Goodness-of-fit					
	χ^2	DF	TLI	CFI	RMSEA
Nokia	198	72	0.96	0.97	0.08
Samsung	299	72	0.93	0.95	0.10
iPhone	420	73	0.90	0.92	0.13

Source: own estimations

The direct effects of indicators and latent variables are all significant. Since the data correspond to the univariate normality but not the multivariate normality assumption, it is important to check the validity of the model with the parametric bootstrap procedure, which is independent from the multivariate normality assumption (Schumacker & Lomax, 2010). The significance and parameters of ML (Maximum Likelihood) estimation correspond to the significance levels and parameters of the parametric bootstrap procedure on a sample of 1,200 with a minimum difference. All these indicate that even in the absence of multivariate normality the study can accept the maximum likelihood estimates of the model. The low values (all well below 2.58) of the standardized residuum matrix affirm the excellent fit of our model as well.

5.1. Assessment of Reliability and Validity of Measurement Models

As the model operationalizes first-order latent variables in reflective measurement models, the assessment of reliability and validity is possible with the classical test theory. The assessment of reliability and validity (*Table 3*) follows Hair et al.'s (2009) indications, according to which the study uses four indicators in assessing the convergent validity.

Table 3. *Convergent validity test*

	Nokia				**Samsung**				**iPhone**			
	CR	**AVE**	**SRW**	**SMC**	**CR**	**AVE**	**SRW**	**SMC**	**CR**	**AVE**	**SRW**	**SMC**
Advantage	0.91	0.73			0.91	0.72			0.93	0.77		
AV1			0.93	0.86			0.91	0.82			0.95	0.91
AV2			0.91	0.82			0.92	0.85			0.93	0.86
AV3			0.75	0.56			0.78	0.6			0.79	0.62
AV4			0.82	0.67			0.8	0.64			0.83	0.69

	Nokia				Samsung				iPhone			
	CR	**AVE**	**SRW**	**SMC**	**CR**	**AVE**	**SRW**	**SMC**	**CR**	**AVE**	**SRW**	**SMC**
Trust	0.91	0.71			0.90	0.68			0.92	0.74		
PQ1			0.79	0.63			0.81	0.59			0.82	0.67
PQ2			0.81	0.66			0.8	0.58			0.81	0.66
TR1			0.87	0.76			0.85	0.77			0.88	0.78
TR2			0.88	0.78			0.86	0.75			0.92	0.84
Purchase intention	0.86	0.67			0.9	0.75			0.92	0.80		
PI1			0.71	0.51			0.85	0.72			0.9	0.81
PI2			0.9	0.81			0.91	0.82			0.92	0.82
PI3			0.84	0.71			0.85	0.72			0.88	0.77
Low search cost	0.92	0.79			0.95	0.86			0.92	0.81		
LSC1			0.89	0.79			0.91	0.82			0.85	0.72
LSC2			0.9	0.81			0.94	0.88			0.92	0.85
LSC3			0.88	0.78			0.94	0.88			0.92	0.85

Source: own estimations

The standardized regression weights (SRW) and the squared multiple correlations (SMC) measure the reliability and validity of indicators, whereas the composite reliability (CR) and average variance extracted (AVE) measure the reliability and validity of latent variables. Amos does not print in the output the latter two indicators, but we compute them based on the formulas from Hair et al. (2009). The squared multiple correlations for every indicator exceed the 0.5 value and the standardized coefficients all exceed the 0.7 value; all this indicates convergent validity. In the case of all four latent variables, the CR exceeds 0.7 and, similarly, the AVE exceeds 0.5, indicating that the variables of the model correctly map the contents of the dimensions.

The assessment of discriminant validity involves different methods. This study considers three of them: the AVE method, nested comparison test of CFA, and confidence intervals of correlation. The first approach compares the average variance extracted (AVE) of two constructs with shared variance measured with the square of the correlation between the two constructs (Fornell & Larcker, 1981). If in the case of both variables AVE is greater than the shared variance, then discriminant validity is supported. The assessment of the Nokia and iPhone models provides support for discrimination as all AVE are greater than the shared variance. In the case of the Samsung brand, the dimensions of brand equity do not pass the AVE test, but they do pass the other two. The confidence intervals of correlations from the bootstrapping estimation prove that the correlation (.86) between Trust (in quality) and Advantage is significantly different from 1. The CFA comparison test indicates that two latent variables represent best the manifest variables in comparison with the one latent solution.

The values of ECVI (.398<.799) and AIC (122.87<246.96) are evidently lower for the two-dimensional solution, indicating evidence of discriminant validity. From the perspective of the brand equity model, a less important problem is the lack of discriminant validity between the consequences of Nokia's brand equity. By including the consequences as composite variables, the problem disappears and the assessment of external validity offers another solution to this problem.

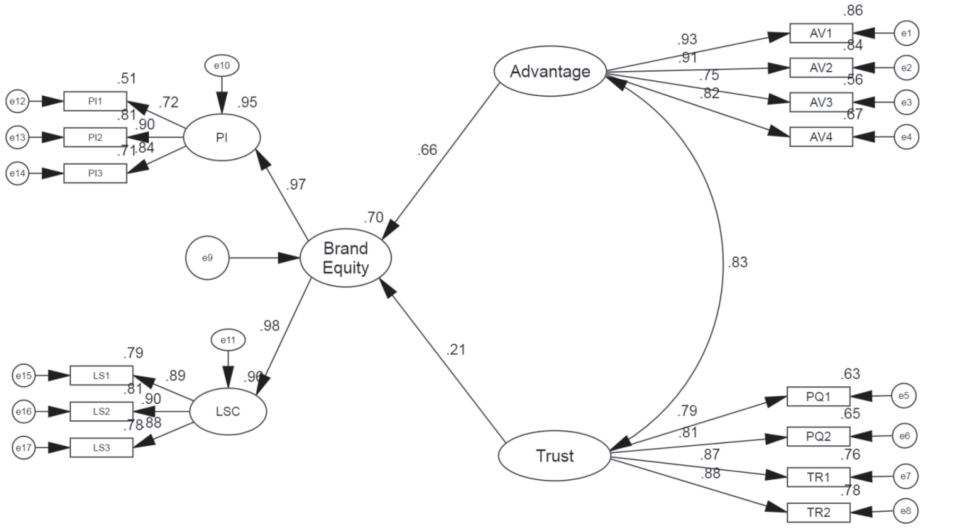
If the causal specification of brand equity is theoretically sound, then the model will fit with other consequences as well. Estimating with two other consequences, Loyalty and OBE (Overall Brand Equity, Yoo & Donthu, 2000), the model remains stable, the indicators show excellent fit. In the case of the model variant with Low Search Cost and OBB as consequences, the differences between AVE values and shared variance provide evidence of discriminant validity in the case of every latent variable.

5.2. Assessment of Reliability and Validity of Causal Relationships

Validity assessment of causal measures is a controversial topic (Diamantopoulos et al., 2008). This study, contrary to skepticism related to the applicability of statistical procedures, stresses the importance of establishment of validity (Edwards & Bagozzi, 2000). The study realizes an assessment of validity following the recommendations of Diamantopoulos et al. (2008) and Bollen (2011).

The present model determines the causal relationships at the level of structural relationships, as first-level latent variables causally determine second-level brand equity. The significant γ-s indicates the validity of the first-level causal measures (Advantage and Trust (in quality)) (Diamantopoulos et al., 2008; Bollen, 2011). Another test of validity is to examine overall fit (Bollen, 2011). *Table 1* provides evidence for excellent fit for the Nokia brand.

For the assessment of external validity, Bollen (2011) suggests embedding the construct in a more complex model with a full set of relationships (determinants and consequences), thus finding the expected effects provide evidence for external validity. The positive sign of high values of path estimates (*Figure 3*) supports external validity for every model. Moreover, testing the model with other latent variables, as Loyalty and OBE, provides further evidence of external validity as the fit indices represent a very good fit (χ^2=244, df=88, TLI=.955, CFI=.963, RMSEA=.075). Following certain recommendations of Diamantopoulos et al. (2008), this study considers the disturbance term (ζ) one of the most important indicators of construct validity. The standardized value of the disturbance provides information about the variance explained. The two-dimensional structure is able to explain 70% of the brand equity; dimension variance in the case of the Nokia brand supports construct validity.



Source: own estimations

Figure 3. *Standardized estimates of brand equity model (Nokia brand)*

6. Discussion

6.1. Conclusions

This research answers the main question of the present study, namely, which are those brand-related concepts that can enter an associative structure where they are simultaneously causing something, with a two-dimensional model. The findings indicate that in this case only two concepts, namely trust in a brand and the advantages that a brand offers, can be built into a causal structural model.

The result of the present paper and other empirical results (Yoo & Donthu, 2000; Netemeyer et al., 2004; Atilgan et al., 2009; Jensen & Klastrup, 2009) propose a simpler structure.

Owing to the causal specification, this study finds both a theoretically and practically useful result. According to this result, consumer-based brand equity is a two-dimensional construct. Trust (in quality) in this context represents something that connects a consumer to a brand. In this sense, the Trust dimension contains the brand-related emotional element. Advantage is what a brand provides a consumer with; thus, this dimension represents the rational dimension of brand equity.

The study offers plausible theoretical and methodological arguments why awareness could not be included in a CBBE model. The authors consider that awareness actually refers directly to the node in the associative network that

stores information related to the brand name; consequently, it cannot be regarded as an association.

Important empirical results confirm the simpler structure. In Netemeyer et al. (2004), the two dimensions of brand equity cause willingness to pay price premium. In the Yoo and Donthu (2000) model, if the authors correctly interpret loyalty as a consequence, this will also result in two dimensions; Jensen and Klastrup (2009) accept two models with four and three dimensions respectively. The present model starts in a different way; still, the final dimensions of the model resemble the dimensions of the mentioned studies. In Netemeyer et al. (2004), PQ/PVC (Perceived Quality/Perceived Value for the Cost) and Uniqueness together determine the willingness to pay premium price, while the credibility of a brand is one of the central elements of the Erdem and Swait (1998) model, one component of which is trust; Jensen and Klastrup (2008) accept two models and estimate one of them with the following three dimensions: Product Quality, Differentiation, Trust and Credibility.

This study manages to highlight an essential problem with the reflective specification of consumer-based brand equity. Using reflective specification, it makes possible to fit an even higher number of constructs into the model as they will share variance due to the halo effect and the common method. Consequently, a high number of consumer-based brand equity models can be built without knowing which are the dimensions capable of determining, causing something together. For example, in Lehman et al. (2008), the 27 constructs shared more than 60% of variance due to the common method bias.

6.2. Limitations and Further Research

The present research has some limitations. First of all, the sample is not randomly drawn, but the sample distribution of age and gender reflects the population distribution of these two variables.

The model is valid for one product category and a restricted number of brands, and it does not provide cultural validity.

The study considers every provided solution of the base brand (private label, fictive brand, weakest brand) comparison problematic. One cannot surely state that private labels do not have brand equity; in many industries, there are no private labels to use as base brand – it is hard to find an appropriate method for selecting the weakest brand. Using a fictive brand will result in irrelevant answers. As a consequence, the study does not deal with the base brand issue, but it considers testing the possibility of introducing the market leader brand as a base brand as a possible future research problem.

While devising the model, the study assumes that brand equity measurement is possible among non-users as well. However, on the basis of the respondents' answers

and the experiences of assessment of fit, the study formulates the need for a certain degree of awareness and knowledge among respondents to assure model stability. Consequently, during data collection, the researcher should filter respondents to exclude those without knowledge and experience with the specific brand.

Acknowledgements

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References

Aaker, D. A. (1989). Managing assets and skills: the key to a sustainable competitive advantage. *California Management Review* 31(2): 91–106.

(1991). *Managing brand equity: Capitalizing on the value of a brand name*. New York: Free Press.

(1996). Measuring brand equity across products and markets. *California Management Review* 38(3): 102–120.

Achenbaum, Alvin A. (1993). The mismanagement of brand equity. In: Lewis, Ian M. (ed.), *ARF Fifth Annual Advertising and Promotion Workshop*. Pennysilvania: The New York Hilton.

Agarwal, M. K.; Rao, V. R. (1996). An empirical comparison of consumer-based measures of brand equity. *Marketing Letters* 7(3): 237–247.

Ailawadi, K. L.; Lehman, D. R.; Neslin, S. (2003). Revenue premium as an outcome measure of brand equity. *Journal of Marketing* 67(4): 1–17.

Akerlof, G. A. (1970). The market for "lemons": quality uncertainty and the market mechanism. *The Quarterly Journal of Economics* 84(3): 488–500.

Atilgan, E.; Akinci, S.; Aksoy, S.; Kaynak, E. (2009), Customer-based brand equity for global brands: a multinational approach. *Journal of Euromarketing* 18(2): 115–132.

Baldauf, A.; Cravens, K. S.; Diamantopoulos, A.; Zeugner-Roth, K. P. (2009). The impact of product-country image and marketing efforts on retailer-perceived brand equity: an empirical analysis. *Journal of Retailing* 85(4): 437–452.

Bauer, A.; Berács, J. (2006). *Marketing*. Budapest: Aula.

Betts, S. C.; Taran, Z. (2004). The 'brand halo' effect on durable goods prices: brand reliability and the used car market. *Academy of Marketing Studies Journal* 8(1): 7–18.

Boatwright, P.; Ajay, K.; Zhang, W. (2008). Should consumers use the halo to form product evaluations. *Management Science* 54(1): 217–223.

Bollen, K. (2011). Evaluating effect, composite, and causal indicators in structural equation models. *MIS Quarterly* 35(2): 359–372.

Boo, S.; Busser, J.; Baloglu, S. (2009). A model of customer-based brand equity and its application to multiple destinations. *Tourism Management* 30(2): 219–231.

Brand Asset Valuator, downloaded from: http://www.yrbav.com/, on: 02.25.2012.

BrandZ, downloaded from: http://www.wpp.com/wpp/marketing/brandz, on: 02.25.2012.

Chau, P.; Ho, C. (2008). Developing consumer-based service brand equity via the Internet: the role of personalization and triability. *Journal of Organizational and Electronic Commerce* 18(3): 197–223.

Chaudhuri, A.; Holbrook, M. B. (2001). The chain of effects from brand trust and brand affect to brand performance: the role of brand loyalty. *Journal of Marketing* 65(2): 81–93.

Christodoulides, G.; de Chernatony, L.; Furrer, O.; Shiu, E.; Abimola, T. (2006). Conceptualizing and measuring the equity of online brands. *Journal of Marketing Management* 22(7–8): 799–825.

Cobb-Walgren, C. J.; Beal C.; N. Donthu (1995). Brand equity, brand preferences, and purchase intent. *Journal of Advertising* 24(3): 25–40.

Delgado, E.; Munuera, J. L. (2005). Does brand trust matter to brand equity? *Journal of Product and Brand Management* 14(3): 187–196.

Delgado, E.; Munuera, J. L.; Yagüe, M. J. (2003). Development and validation of a brand trust scale. *International Journal of Marketing Research* 45(1): 35–54.

Diamantopoulos, A.; Riefler, P.; Roth, K. P. (2008). Advancing formative measurement models. *Journal of Business Research* 61(12): 1203–1218.

Dillon, W. R.; Madden, T. J.; Kirmani, A.; Mukherjee, S. (2001). Understanding what's in a brand rating: a model for assessing brand and attribute effects and their relationship to brand equity. *Journal of Marketing Research* 38(4): 415–430.

Edwards, J. R.; Bagozzi, R. (2000). On the nature and direction of relationships between constructs and measures. *Psychological Methods* 5(2): 155–174.

Erdem, T.; Swait, J. (1998). Brand equity as a signaling phenomenon. *Journal of Consumer Psychology* 7(2): 131–157.

Erdem, T.; Swait, J.; Valenzuela, A. (2006). Brands as signals: a cross-country validation study. *Journal of Marketing* 70(1): 34–49.

Farquhar, P. H. (1989). Managing brand equity. *Marketing Research* 1(3): 24–33.

Fornell, C.; Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research* 18(1): 39–50.

Garson, G. D. (2011). Structural equation modeling. Statnotes: topics in multivariate analysis. North Carolina State University, downloaded from: http://faculty.chass.ncsu.edu/garson/pa765/statnote.htm, on: 1/18/2011.

Hair, J. F.; Anderson, R.; Tatham, R.; Black, W. (2009). *Multivariate Data Analysis*. New York: Prentice Hall.

Hooley, G.; Cox, T.; Fahy, J.; Shipley, D.; Berács, J.; Fonfara, K.; Snoj B. (2000), Market orientation in the transition economies of central Europe: tests of the Narver and Slater market orientation scales. *Journal of Business Research* 50(3): 273–285.

Hoyer, W. D. (1984). An examination of consumer decision making for common repeat purchase product. *Journal of Consumer Research* 11(3): 822–829.

Hoyer, W. D.; Brown, S. P. (1990). Effects of brand awareness on choice for a common, repeat purchase product. *Journal of Consumer Research* 17(2): 141–148.

Huang, R.; Sarigöllü, E. (2012). How brand awareness relates to market outcome, brand equity, and the marketing mix. *Journal of Business Research* 65(1): 92–99.

Jensen, M. B.; Klastrup, K. (2008). Towards a B2B customer-based brand equity model. *Journal of Targeting, Measurement and Analysis for Marketing* 16(2): 122–128.

Kapferer, J. N. (2008). The new Strategic brand management. London and Philadelphia: Kogan Page.

Keller, K. L. (1993) Conceptualizing, measuring, and managing customer-based brand equity. *Journal of Marketing* 57(1): 1–22.

Keller, K. L.; Lehmann, D. R. (2003). How do brands create value? *Marketing Management* 12(3): 26–31.

Kim, J.; Hyun, Y. J. (2010). A model to investigate the influence of marketing-mix efforts and corporate image on brand equity in the IT software sector. *Industrial Marketing Management* 40(3): 424–438.

Laroche, M.; Kim, C.; Zhou, L. (1996). Brand familiarity and confidence as determinants of purchase intention: an empirical test in a multiple brand context. *Journal of Business Research* 37(2): 115–120.

Lehmann, D. R.; Keller, K. L.; Farley, J. U. (2008). The structure of survey-based brand metrics. *Journal of International Marketing* 16(4): 29–56.

Leong, S. M. (1993). Consumer decision making for common, repeat purchase products: a dual replication. *Journal of Consumer Psychology* 2(2): 193–208.

Macdonald, E.; Sharp B. (2000). Brand awareness effects on consumer decision making for a common, repeat purchase product: a replication. *Journal of Business Research* 48(1): 5–15.

Martensen, A.; Gronholdt, L. (2004). Building brand equity: a customer-based modeling approach. *Journal of Management Systems* 16(3): 37–51.

McDonald, R. P.; Ho, M. R. (2002). Principles and practice in reporting structural equation analyses. *Psychological Methods* 7(1): 64–82.

Netemeyer, R. G.; Krishnan, B.; Pullig, C.; Wang, G.; Yagci, M.; Dean, D.; Ricks, J.; Wirth, F. (2004). Developing and validating measures of facets of customer-based brand equity. *Journal of Business Research* 57(2): 209–224.

Pashigian, B. P.; Bowen, B. (1994). The rising cost of time of females, the growth of national brands, and the supply of retail services. *Economic Inquiry* 32(1): 33–65.

Patterson, A. (2012). Social-networkers of the world, unite and take over: a meta-introspective perspective on the Facebook brand. *Journal of Business Research* 65(4): 527–534.

Peres, R.; Muller, E.; Mahajan V. (2010). Innovation diffusion and new product growth models: A critical review and research directions. *International Journal of Research in Marketing* 27(2): 91–106.

Raggio, R. D.; Leone, R. P. (2006). The theoretical separation of brand equity and brand value: managerial implications for strategic planning. *Journal of Brand Management* 14(5): 380–395.

Ramello, G. (2006). What's in a sign? Trademark law and economic theory. *Journal of Economic Surveys* 20(4): 547–565.

Schumacker, R. E.; Lomax, R. G. (2010). *A beginner's guide to structural Equation modeling*. Mahwah: Lawrence Erlbaum Associates.

Sengupta, A.; Greetham, D. V. (2010). Dynamics of brand competition: effects of unobserved social networks. *Journal of Economic Dynamics and Control* 34(12): 2391–2406.

Sharp, B.; Dawes, J. (2001). What is differentiation and how does it work. *Journal of Marketing Management* 17(7–8): 739–759.

Srinivasan, V.; Park, C. Su; Chang, D. R. (2005). An approach to the measurement, analysis, and prediction of brand equity and its sources. *Management Science* 51(9): 1433–1448.

Tomarken, A. J.; Waller, N. G. (2003). Potential problems with "well-fitting" models. *Journal of Abnormal Psychology* 112(4): 578–598.

Tsao, H.; Pitt, L. F.; Berthon, P. (2006). An experimental study of brand signal quality of products in an asymmetric information environment. *Omega: The International Journal of Management Science*. 34(4): 397–405.

Ullman, J. B. (2006). Structural equation modeling: reviewing the basics and moving forward. *Journal of Personality Assessment* 87(1): 35–50.

Washburn, J. H.; Plank, R. E. (2002). Measuring brand equity: an evaluation of a consumer-based brand equity scale. *Journal of Marketing Theory and Practice* 10(1): 46–62.

Yoo, B.; Donthu, N. (1997). *Developing and validating a consumer-based overall brand equity scale for Americans and Koreans: an extension of Aaker's and Keller's conceptualizations*. Paper Presented at AMA Summer Educators Conference, Chicago.

(2000). Developing and validating a multidimensional consumer-based brand equity scale. *Journal of Business Research* 52(1): 1–14.

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If Development, Then Sustainability

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Abstract. The aim of this study is to explore how the effects of components belonging to the concept of strategic management system influence outstanding achievement and success in the processing industry in Hungary as well as the sustainability success component within that. In order to do that, the study defines the factors having an influence. Thereafter, it explains the successful operation of companies with the help of factors emerging via path analysis using regression models. It uses the balanced scorecard as a tool for success criteria describing success. This is a non-market aspect that has an impact on the whole system, making it of crucial importance. Via the exploration of effects, it can be shown the deliberate use of those factors that generate outstanding results and success from the point of view of sustainability, and thus internal development, customer appreciation, and financial success. By taking the results of the research into consideration, it will also be revealed that success factors in the processing industry in Hungary have the most direct and the largest impact on outstanding sustainability performance.

Keywords: balanced scorecard, strategy, success, sustainability
JEL-codes: M10, M12, M14

1. Introduction

Numerous research projects have already aimed at finding out what makes a company successful. Is it enough, however, to consider only financial, customer, and internal aspects when determining success? The answer is clearly no. Currently, in the 21st century, sustainability is playing a prominent role. Companies prepare sustainability reports annually and the inclusion of social and environmental aspects in the creation of their strategy is a main priority. Now it is impossible to evade the issue of sustainability as a success factor – to find out the environmental, health, security, employment, and community performance of companies. Therefore, it is at least as important as the earlier

identified aspects. It has become an important part of strategy; hence, it may be looked upon as one of the factors of success. This means that the promotion of sustainability does not decrease the chances of success, but, on the contrary, it may help achieving it. If properly handled, it may also function as the source of new possibilities, innovation, and competitive advantage. It is important because companies have to focus not only on a single objective, that is, the interests of the owner, but they must also provide value to everyone involved (Porter & Kramer, 2007). That is why sustainability has been playing a more and more significant role, which was recognized by organizations as well.

Therefore, sustainability has become just as equally important nowadays as financial, customer, internal processes, learning and growth perspectives. Companies prepare sustainability reports annually and the inclusion of social and environmental aspects in the creation of their strategy is a main priority. Hence, it is necessary to handle sustainability as a highly crucial issue. The study tackles the issue of sustainability with a high priority in this system as a success component, using it in an empirical research – as one of the pioneers –, as the fifth perspective among the other four classic ones. It makes an attempt to explore how a company may become more successful from the sustainability perspective, how its corresponding performance may improve. The aim is to work out a model showing how tools generating success correlate with sustainability performance.

The analysis of how to achieve success already began in the mid-20th century, and research is being conducted currently as well so as to identify the tools which may put a company ahead of its competitors. T. J. Peters and R. H. Waterman took the first remarkable step when their book was published on the subject in 1982 (Peters & Waterman, 1982). It was followed by research projects such as Kotter and Heskett (1992) analysing the impact of organizational culture on success. Collins and Porras (2000) were seeking the answer to the question as to what permanently successful companies do in order to last. Several researchers inspected time-pacing as a central factor, among which the analysis of Eisenhardt and Brown (1998) related to transitions and time-pacing proved to be the most important one. Foster and Kaplan (2001) focused on the significance of transformation, whereas Collins (2001) examined what makes a good company an excellent one. It is indispensible to mention *The Evergreen Project* carried out by Joyce et al. during the early 2000s in order to explore what organizations assessed by them as successful exactly do (Joyce et al., 2003). Spitzer (2007) put the emphasis on the measurement system. Beer (2009) correlates excellent performance with outstanding commitment. The study of Breene and Nunes (2011) calls attention to market relevance, differentiating capabilities, and talent care. According to Rumelt (2011), the effective strategy is often unexpected, but the chances of success remarkably increase if general mistakes are filtered out and if characteristic activities of successful companies are followed.

After the introduction, the study first presents the model employed, and then describes the research process and the characteristics of companies included in it. Following that, it carries out the categorization of success factors via factor analysis. When reaching the results of the research, one may clearly see the inspection of success factors on sustainability via linear regression, path analysis, and logistic regression. It is also shown how sustainability results influence the performance of a company as compared to the others involved. Finally, the study summarizes the emerging results in the conclusion.

2. Material and Methods

The research analyses those companies operating in the processing industry that have more than 50 employees. The reasons for that are that these organizations set the pace for the market, they are the largest employers, thus the scanning of these companies may offer useful results for the largest number of people. The ambition for sustainability is very remarkable in the case of these types of organizations. Preparation of sustainability reports is a must with them, so impacts related to that presumably reveal themselves to the highest extent in their cases.

Success factors will be the independent variables of the research, whereas the success of sustainability perspective will be the dependent variable. The model will be built up this way (*Figure 1*). The results of research projects on success concluded in the past years will formulate the basis for identifying success factor variables, whereas in the case of success the starting point will be the sustainability balanced scorecard, and the study will focus on the sustainability aspect. Based on the research of specialized literature, the key issue is what kind of correlations can be revealed between particular success factors and the performance related to the sustainability perspective. The hypothesis will be formulated stemming from this question, assuming that strategic success factors have the highest impact because with companies it is primarily strategic plans and solutions which target the improvement of sustainability performance.

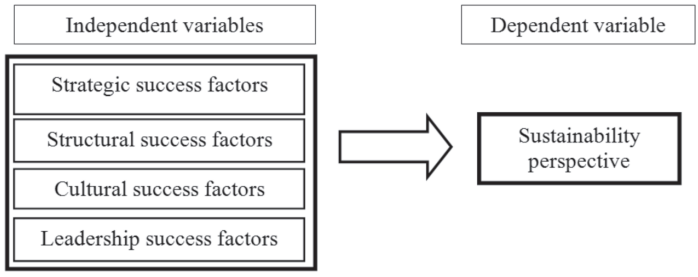

Figure 1. *The model of the research*

Collection of data necessary for the analysis has been conducted via a query of questionnaires. The data collection took place between July and November 2014. The questionnaire of the research consisted of three main parts. The first one contained questions – 47 altogether – related to success factors, the measurement of which was carried out on a Likert scale. The query of the performance data forming the basis of the measurement of success took place in accordance with five aspects and with 4-5 questions related to each aspect. The questionnaire inquired value quotients in order to ensure equality for the companies and so as to strive for maximum objectivity.

After the tests have been concluded, the leaders of companies put in the focus of research filled in the final questionnaire. Upon handing in the forms, a sample of 230 pieces was disposable for statistical analyses. This number of samples fully satisfies the requirements of the applied statistical methods.

Companies having more than 50 employees and operating in Hungary have been brought into the focus of the research. 90 per cent of them were under private ownership, half of which had Hungarian owners and half of which were owned by foreigners. 79 per cent of the management was Hungarian and only 17% was of a mixed composition (Hungarian and foreign). The annual net turnover has exceeded 10 million EUR in case of 68 per cent of the companies, which was true for 59 per cent of them as far as their balance sheet total was concerned.

Success factors have been recorded – as already mentioned above – based on earlier research projects on success. Only those identified tools remained in the research which were measurable and scannable. Identification and grouping of remaining tools was conducted by factor analysis. The analysis of impacts has been carried out via linear regression models and logistic regression.

3. Success Factors

The research focuses on four areas concerning success factors: strategy – which is the tool of companies for their future – challenges, attitude to the environment, and solutions originating from cultural peculiarities influencing the activities and mindset of a given community. It also concentrates on the developed structure, which determines the formal and informal exchange of information and the actions, and, finally, on leadership solutions, with the help of which those entitled to lead co-ordinate their co-workers and try to bring out their best. Following the study of specialized literature, factor analysis resulted in five success factors as follows:

External Strategic Success Factors

– Fine-tuning: slight modification of ongoing strategy due to changes in the environment as a result of new technology, social trends, state regulations, or pioneer products of competitors (Joyce, Nohria, and Robertson, 2003).

– Time-pacing: The company has performance indicators related to time, clear-cut, choreographed procedures for changes, and the company's pacing for changes follows a well-definable rhythm (Grove, 1997; Eisenhardt & Brown, 1999).

Internal Strategic Success Factors

– Long-term plans: The company has set up objectives for a longer period of time – at least for a decade – and their realization is set out step by step (Collins and Porras, 2000).

– Internal communication of strategy: Clear and unambiguous communication of strategy for everyone involved (Kotter 1999; Joyce, Nohria, and Robertson, 2003; Ligeti, 2007).

Structural Success Factors

– Relationship with customers: Endeavour to build up a relationship with the customers, which goes deeper than transactions. Setting up an internal system following a service provider – customer attitude, in which the next process is the buyer of the previous one. As if everyone were in direct contact with the end user (Peters & Waterman, 1982).

– Proposal handling: The company has an organizational unit, a pre-created solution for considering and implementing ideas, modifications intended for betterment, proposals and developments improving the efficiency, and profits submitted by co-workers (Kotter & Heskett, 1992; Kotter, 1999; Katzenbach, 2000).

Cultural Success Factors

– Teamwork: Cohesion, teamwork based on mutual help. People are happy to go to work because they appreciate and respect one another (Kotter, 1999).

– Multi-skill labour force: The company makes an effort to employ co-workers deployable in several areas.

– Intuitivity: Leadership is conducted not only with systematic methods and well-established practices but also intuitively based on inner instinct (Joyce, Nohria, and Robertson 2003).

Leadership Success Factors

– Talent care: Senior management takes part in selecting and breeding talent (Christiansen & Overdorf, 2000; Joyce, Nohria, and Robertson 2003; Breene & Nunes 2011).

– Delegation: Involving employees in decision-making and preparation as well as the development of operational mechanisms (Dinya, 1999).

Following the identification and exploration of factors to be analysed, the impacts on performance have been determined via path analysis and logistic regression. As an element of the sustainability balanced scorecard, the sustainability perspective has been scanned by several indicators:

– the rate of charity donations, financial support, or payment in kind compared to net turnover;

– graduate starting salary compared to minimum wage;

– fines related to environmental or legal non-compliance compared to net turnover;
– environmental investments compared to total net turnover;
– total waste recycled earlier emitted by the company;
– the percentage of renewable energy source (solar, wind, biomass, hydro and geothermal) compared to the total energy used by the company;
– ratio of women in the management.

4. Results and Discussion

4.1. Path Analysis

For the analysis of impacts related to the sustainability perspective, the first statistical method used was path analysis. The sustainability balanced scorecard perspectives are interrelated and they are not independent from each other (Kaplan & Norton, 2000, 2002). The non-market factors, such as sustainability, have an effect on all the other perspectives (Figge, Hahn, Shaltegger, and Wagner, 2002), whereas during their analysis only independent factors, i.e. independent variables, have an impact on them. According to the significance test related to the validity of regression models, each model is significant. The examination of conditions concerning variables and error terms has been conducted, and it showed conformity in each and every case. The heteroscedasticity of error terms was tested with the White-test. First, relationships have been determined based on the correlations among factors, with the help of which linear regression models used for the path analysis could be outlined, thus defining the internal effects. With the results, identified paths having an impact on success related to the sustainability perspective can be laid down (*Figure 2*). No effects of soft factors, such as culture and leadership, have been revealed. Only strategic and structural success factors improve the success of the analysed aspect related to companies included in the research.

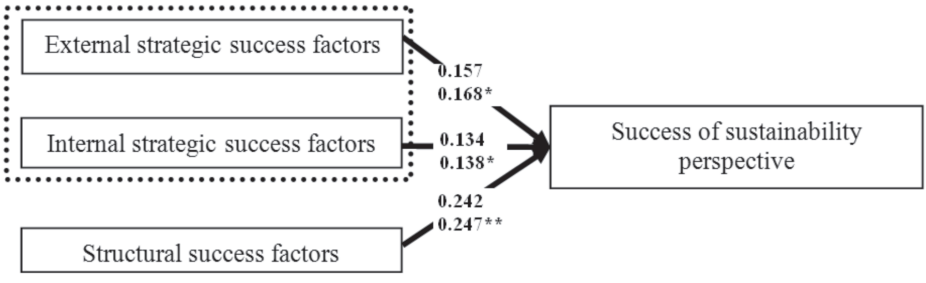

Figure 2. *Path analysis*

The numbers in the higher position on the arrows in the figure show the β value indicating the slope of the regression line, whereas the numbers below them are the values of the Pearson product–moment correlation coefficient related to the strength of correlation. In the case of correlation, the double asterisk following the numbers indicates 1 per cent significance level, while the single asterisk denotes a 5 per cent significance level.

The figure shows that external strategic success factors have a direct impact on sustainability performance in a positive way. Accordingly, the fine-tuning and pre-planned time-pacing of strategy leads to higher sustainability results. Internal strategic success factors have a slightly lower effect, thus long-term plans and clear communication to everyone involved have a positive impact. However, the highest influence occurs with structural success factors. This means that organizational solutions, which help to achieve better service and promote proposals intended for improvement, increase sustainability performance to the highest extent.

Following the analysis of the impact of success factors on sustainability, the study deals with the issue – via path analysis – of how sustainability results affect the other perspectives based on the balanced scorecard (*Figure 3*). Thus, correlations between the elements of the balanced scorecard become visible, and it is revealed that generally assumed correlations between the four "classical" elements really exist. The sustainability perspective has, however, a direct effect only on customer perspective and, via that, an indirect impact on financial perspective (tables 1-2). This shows that sustainability in Hungary is rather a marketing aspect for the time being and they do not have a demonstrable impact on operation, learning, and growth. Sustainability has a value-generating effect for customers; it increases their satisfaction, and thus they prefer to choose services and products of the company, which has a positive impact on the financial aspect as well.

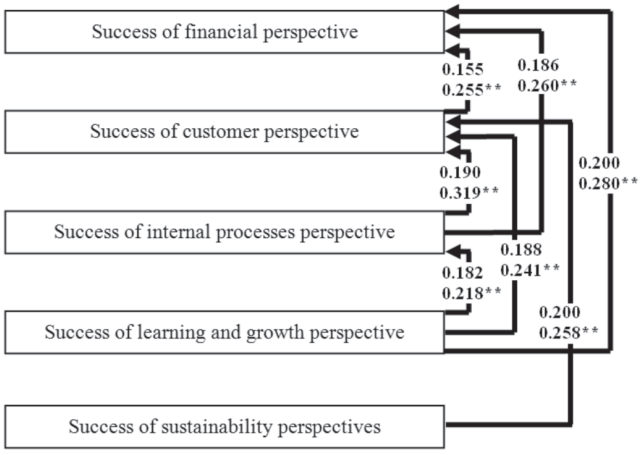

Figure 3. *Sustainability balanced scorecard path analysis*

Table 1. *The effect of sustainability balanced scorecard on the financial and customer perspectives*

Independent variables	Success of financial perspective			Success of customer perspective		
	Direct	Indirect	Total	Direct	Indirect	Total
Success of financial perspective	-	-	-	-	-	-
Success of customer perspective	0.155	-	0.155	-	-	-
Success of internal processes perspective	0.186	0.029	0.215	0.190	-	0.190
Success of learning and growth perspective	0.200	0.068	0.268	0.188	0.035	0.223
Success of sustainability perspectives	-	0.031	0.031	0.200	-	0.200

Table 2. *The effect of sustainability balanced scorecard on the internal process, learning and growth perspectives*

Independent variables	Success of internal processes perspective			Success of learning and growth perspective		
	Direct	Indirect	Total	Direct	Indirect	Total
Success of financial perspective	-	-	-	-	-	-
Success of customer perspective	-	-	-	-	-	-
Success of internal processes perspective	-	-	-	-	-	-
Success of learning and growth perspective	0.182	-	0.182	-	-	-
Success of sustainability perspectives	-	-	-	-	-	-

4.2. Logistic Regression

The analysis of sustainability was carried out from another aspect as well through a logistic regression. Here, outstanding, successful sustainability performance has been the dependent variable. It is this variable on which the effect of factors and their degree of influence must be determined. The study thus examines whether the success of sustainability depends on the identified success factors as well as which instruments with what probability improve it. It analyses the impacts of success factors identified via factor analysis in the case of this method too. First, it inspects the improvement of odds ratios generated by these success factors. Afterwards, it analyses the partial effects of factors, i.e. how many times the influence increases the chances that the sustainability performance of a given company goes above the average, that it becomes outstanding. In order to do that, it was necessary to decide what kind of result may be called successful or outstanding. So as to make this decision, data related to companies operating in the processing industry provided a benchmark. Based on the analysis and the assessment of results related to companies included, the research determined that a company may be called successful and has an outstanding performance

if its performance related to the analysed aspect and success criterion exceeds the average results of the companies present on the market concerning the same aspect by 10 per cent. This applies to sustainability indicators too. Personal consultations with members of senior management have confirmed this categorization as well. Accordingly, two groups have been defined based on the standardized performance indicator described by sustainability performance indicators. These two groups are: companies with outstanding performance and those with average or poor performance.

During the analysis of the individual impacts of factors, the Wald statistics shows significance (*Table 3*). It is also shown that the impact of external and internal strategic and structural success factors is significant in this case (*Table 4*).

Table 3. *Model significance*

	B	S.E.	Wald	df	Sig.	Exp(B)
Step 0 Constant	-0.726	0.141	26.636	1	0.000	0.484

Table 4. *Variables in the equation (Step 0)*

Step 0	Score	df	Sig.
External Strategic Success Factors	11.427	1	0.001
Internal Strategic Success Factors	11.299	1	0.001
Structural Success Factors	6.011	1	0.014
Cultural Success Factors	1.222	1	0.269
Leadership Success Factors	1.302	1	0.254
Constant	29.309	5	0.000

It can be stated in the first phase that if we know nothing about the sample it can be determined randomly with a 67.4 per cent certainty, whether a company is successful from the sustainability aspect or not. Knowing the variables involved in the research, in the second phase, this certainty, however, increases to 74.8 per cent. In this phase already, partial impacts emerge. The model developed via the inclusion of these factors is significant (*Table 5*). The value of the Nagelkerke R square shows that the combination of the five independent variables explains 18 per cent of the variance of the dependent variable (*Table 6*). The 7.4 per cent increase of probability shows that the analysed success factors have an impact on the success of the sustainability perspective and in the case of their deliberate use chances of success increase by 7.4 per cent (*Table 7*). Since the real business environment is complex and success is thereby the resultant of many internal and external impacts, this change is remarkable. This may be stated also because the analysed success factors are related to subtle details, and thus the objective, real-life situation cannot be completely covered with them.

Table 5. *Omnibus tests of model coefficients*

	Chi-square	df	Sig.
Step	31.793	5	0.000
Block	31.793	5	0.000
Model	31.793	5	0.000

Table 6. *Model summary*

Model Summary	-2 Log likelihood	Cox and Snell R Square	Nagelkerke R Square
Step 1	258.638	0.129	0.180

Table 7. *Classification table difference*

Overall Percentage Correct		
Block 0: Beginning Block	**Block 1: Method = Enter**	**Difference**
67.4%	74.8%	7.4%

The study in the second phase reveals which success factors and to what extent they influence the success of sustainability, and what provides a 7.4 per cent increase. They are the external strategic and structural success factors whose impacts are significant in the case of partial analysis too. These factors have an impact on the success of sustainability. The odds ratios (Exp (B)) denote what the chances of success are if the effect of the other variables is kept under control. Results provided that way (*Table 8*) prove that those companies included in the research which fine-tune their strategy due to changes in social trends time-pace their activity and move with the market – these will belong to successful organizations from the point of view of sustainability perspective by a 77.1 per cent larger chance. A customer-oriented organizational structure encouraging proposals for improvement increases this chance by 81.7 per cent. Those companies which prepare long-term plans and communicate strategic intentions internally to everyone involved belong to successful companies from the aspect of sustainability perspective with a 48.6 per cent higher chance.

Table 8. *Variables in the equation (Step 1)*

Step 1	B	S.E.	Wald	df	Sig.	Exp (B)
External Strategic Success Factors	0.572	0.178	10.256	1	0.001	1.771
Internal Strategic Success Factors	0.597	0.182	10.778	1	0.001	1.817
Structural Success Factors	0.396	0.167	5.654	1	0.017	1.486
Cultural Success Factors	0.222	0.167	1.760	1	0.185	1.248
Leadership Success Factors	0.132	0.176	0.562	1	0.453	1.141
Constant	-0.856	0.158	29.203	1	0.000	0.425

5. Conclusion

The results confirm the opinion of former Intel CEO, András Gróf (Andrew Grove), namely that focusing on changes is of primary importance. According to him, inflection points determine success because it depends on them how a company is able to manage transitions. Grove believes that the pacing of these points and transitions is the key to a company's success and sustainability (Grove, 1997). This idea is supported by Eisenhardt and Brown too, who found out during their research that companies having a simple, clear, and choreographed procedure for transitions and harmonizing their own pace with the rhythm of the market will be successful (Eisenhardt & Brown, 1999). Correlations revealed by this study initiate concordance with the statement of the *Evergreen Project*, according to which constant monitoring of the market is essential as well as the fine-tuning of strategy in the case of changes. The results of Collins and Porras have been also verified: they declare that in order to achieve success a long-term goal must be set up, the method of implementation of which needs to be pre-created. One needs to know the answer to the question what the company wishes to achieve, where it imagines its position within 20–30 years, and how it wishes to get there (Collins & Porras, 2000). And this needs to be made clear internally to each and every co-worker (Kotter, 1999). The results, however, do not share the views related to the study of Kotter and Heskett, which states that cultural tools have a significant impact on performance (Kotter & Heskett, 1992). Nevertheless, it is important to mention the remarkable effect of structural instruments. The strong success-generating impact of organizational structures promoting proposals intended for improvement shows that the consideration of the sustainability perspective is of primary importance with developments. This may be explained by new generations entering the labour market. As Braun concludes, the principal factor of the next generation following the Y generation will be sustainability. This way of thinking permeates every single action carried out by them, and if companies support such ambitions the sustainability performance will improve notably (Braun, 2013).

By assessing the results, it may be stated that companies having more than 50 employees and operating in the processing industry in Hungary prefer using strategic and structural elements in order to achieve a successful sustainability. Accordingly, if a company immediately takes new social trends into account, prepares itself for transitions, moves with the market, makes its plans for a longer term, and clearly communicates the strategy, then the sustainable development of that company will improve. This will also improve the results of the customer perspective as well as the financial indicators in the long run.

References

Beer, M. (2009). *High commitment, high performance: how to build a resilient organization for sustained advantage.* San Francisco: John Wiley & Sons.

Braun, R. (2013). A vállalatok politikája – A vállalati közösségek és a vállalati stratégia, *Vezetéstudomány* 44(1): 18–28.

Breene, R. T. S.; Nunes, P. F. (2011). Reinvent your business before it's too late. *Harvard Business Review* 89(1–2): 80–87.

Christiansen, C. M.; Overdorf, M. (2000). Meeting the challange of disruptive change, *Harvard Business Review* 78(2), 66–76.

Collins, J. (2001). Good to great. Why some companies make the leap… and others don't. New York: Harper Business.

Collins, C. C.; Porras, J. I. (2000). *Built to last: Successful habits of visionary companies (3rd ed.)*. London: Random House Business Books.

Dinya, L. (1999). *Menedzsment: Sikeres vállalkozások*. Szeged: JATE-GTK.

Eisenhardt, K. M.; Brown, S. L. (1998). Time pacing: competing in markets that won't stand still. *Harvard Business Review* 76(2): 59–69.

Figge, F.; Hahn, T.; Schaltegger, S.; Wagner, M. (2002). The sustainability balanced scorecard – linking sustainability management to business strategy. *Business Strategy and the Environment* 11(5): 269–284.

Foster, R.; Kaplan, S. (2001). *Creative destruction: why companies that are built to last underperform the market – and how to successfully transform them*. New York: Currency Doubleday.

Grove, A. (1997). *Only the paranoid survive*. New York: Harper Collins Publishers.

Joyce, W.; Nohria, N.; Robertson, B. (2003). *What really works: The 4+2 formula for sustained business success*. New York: HarperBusiness.

Kaplan, R. S.; Norton, D. P. (2000). *Balanced scorecard (Eszköz, ami mozgásba hozza a stratégiát – BSC – Kiegyensúlyozott stratégiai mutatószám-rendszer)*. Budapest: KJK-KERSZÖV.

(2002). *A Stratégiaközpontú szervezet: Hogyan lesznek sikeresek a Balanced Scorecard vállalatok az új üzleti környezetben?* Budapest: Panem Kiadó–IFUA Horváth & Partner.

Katzenbach, J. R. (2000). *Peak performance: aligning the hearts and minds of your employees*. Boston: Harvard Business School Press.

Kotter, J. P. (1999). *A Változások Irányítása*. Budapest: Kossuth Kiadó.

Kotter, J. P.; Heskett, J. L. (1992). *Corporate culture and performance*. New York: Free Press.

Ligeti, Gy. (2007). *CSR: Vállalati Felelősségvállalás*. Budapest: Kurt Lewin Alapítvány.

Peters, T. J.; Waterman, R. H. (1982). *In search of excellence: lessons from America's best-run companies*. New York: Harper & Row.

Porter, M. E.; Kramer, M. R. (2006). Strategy and society: the link between competitive advantage and corporate social responsibility. *Harvard Business Review* 84(12): 78–92.

Rumelt, R. P. (2011). Good strategy, bad strategy: the difference and why it matters. New York: Crown Business.

Spitzer, D. R. (2007). *Transforming performance measurement: rethinking the way we measure and drive organizational success*. New York: AMACOM.

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Rural Youth, Agriculture, and Entrepreneurship: A Case-Study of Hungarian and Romanian Young Villagers

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Abstract. This paper analyses the involvement of Romanian and Hungarian young villagers in the local agriculture and entrepreneurial activities. The first part provides an outlook on the historical evolution and the current situation of agriculture and rural development in Romania and Hungary from the perspective of theoretical positions formulated within economics and the sociology of entrepreneurship as well as rural sociology. The second part discusses the results of a cross-border research and social intervention project conducted in the period of 2012–2013 in ten rural localities from the shared Hungarian–Romanian border region. The questionnaire included questions regarding rural youth integration in the labour market, agriculture, and involvement in entrepreneurial activities as well as social and religious participation. The research has found significant differences between Romanian and Hungarian young villagers with respect to the examined questions.

Keywords: rural youth, agriculture, entrepreneurship, border region, Romania, Hungary
JEL codes: Q1-Agriculture, R1-General Regional Economics, Y8-Related Disciplines

1. Introduction

Literature characterizes rural areas as areas with small density of population, high level of unemployment, low productivity, low income of the population, and the very important role of agricultural activity. In the general process of population aging, the topics regarding youth and the role of the young generation

in economic activity become very important. These considerations have led us in choosing the topic of the present paper.

The idea of this comparative research emerged from the need to integrate the euro-regional outlook and the cross-border approach into the research and development activities within the shared border region of Romania and Hungary. Based on the comparative research data collected during the cross-border project, our paper focuses on the rural youth as a vulnerable group with difficulties of integration in the labour market. The main aspect that interests us, however, is the involvement of the young villagers in entrepreneurial activities and local agriculture, viewed as potential solutions both for rural development and for attenuating the rural unemployment of the young population segments by providing them important means of integration into the local and regional economy.

The focus of the paper is the rural youth and its involvement in agriculture and entrepreneurship.

One of the concrete practical reasons for initiating this social intervention project and the comparative research which was part of it derives from the fact that both in Romania and Hungary youth is the most affected group by unemployment. In 2014, the specific unemployment rate for the group of young people under the age of 25 was 15.7% in OECD countries, while in the EU member's states it was 23.4%. In Romania, it reached 25.7%[1] and in Hungary was as high as 27.2%.[2] A similar situation also characterizes the shared border region of the two states. In 2011 in Bihor County (Romania), the young people who were at the beginning of their professional careers made up 21.38% of the registered unemployed,[3] while in Hajdú-Bihar their proportion was approximately 11% in 2010.[4]

Being aware of the strong social need to improve our understanding of villages and villagers, in the period of 2012–2013, two partner universities, the University of Oradea in Romania and the University of Debrecen in Hungary, implemented a cross-border project with the aim to promote their integration on the euro-regional labour market (Bihor – Hajdú-Bihar Euro-region). By means of analysing socio-economic data and formulating recommendations for public policy decision-makers, the project aimed at contributing to the enhancement of economic competitiveness and the improvement of human resources within the Hungarian–Romanian cross-border area. Its specific objectives were to offer information, counselling, and orientation and to provide institutionalized training services for the rural youth. The direct target group of the project consisted of 300

1 http://www.capital.ro/somajul-in-randul-tinerilor-a-ajuns-la-257-in-romania.html (accessed on: 3.11.2014).

2 http://index.hu/chart/2014/09/24/oecd/ (accessed on: 12.10.2014)

3 http://adlearning.creathink.ro/uploads/publicari/12918_researchstudy%20hu%20jo.pdf (accessed on: 15.09.2014)

4 http://www.dehir.hu/hajdu-bihar/nott-a-munkanelkuliseg-a-megyeben/2011/01/17/ (accessed on 16.09.2014)

youngsters, 150 from each country, and 30 of each of the 10 rural localities. In the first phase of the project, a comparative cross-border research was implemented, inquiring into the factors influencing the integration process.[5]

In light of the research data, rural youth can rightly be considered as a *vulnerable group*, with the meaning of a marginalized group, excluded group, or risk group. All these concepts are in relation with the phenomenon of poverty and social exclusion. The most frequent meaning of vulnerability is that of weakness, lack of defence, or lack of means. The vulnerable groups are those groups where the support lacks and which are often in poverty and cannot use the opportunities or defend themselves in front of the problems they face. Another meaning of vulnerability is the risk that can lead a person to a poverty level which is under a limit that is acceptable by the society. In this larger meaning could be found the young graduates on the labour market, the rural youth on labour market, and the people who migrate for work (Popescu, 2011).

To understand why the rural youth of Romania and Hungary has become a vulnerable group, we will first need to discuss, from the perspective of theoretical positions formulated within economics and the sociology of entrepreneurship, how the rural world developed in Romania and Hungary and what have been the main social and economic transformations of the rural society in both countries during socialism and post-socialism. Building upon this diagnosis, we will then proceed to the analysis of our research data.

The first part of the paper presents the reasons for studying this topic and discusses some theoretical aspects such as entrepreneurs and entrepreneurship (*Section 2*), the Romanian and the Hungarian rural society (sections 3, 4), and the entrepreneurial environment in Romania and Hungary (*Section 5*). The second part of the paper presents the research methodology and the results (sections 7 to 11). The last section presents some conclusions.

2. Entrepreneurs and Entrepreneurship

2.1. Economy and Sociology of Entrepreneurship

The attitude towards risk is a specific feature of people. Few people assume risks when others do not prefer to risk. Between these two types of people, there is, however, a strong similarity, as rightly pointed out by Peter Drucker, one of the main leaders of management science. Those who assume the risk and those who do not assume the risk make two main mistakes throughout a year (Doltu, 2011). The focus of this part of the paper is an analytical debate concerning those people who decide to assume risks, and therefore we use to call them entrepreneurs.

5 http://www.territorialcooperation.eu/frontpage/show/23625 (accessed on: 25.11.2014)

It is very curious that the word "entrepreneurship" is rarely mentioned in the manuals of economics. The word "entrepreneur" is absent from the writings of Adam Smith or David Ricardo. Marx is not focusing on "entrepreneur" either but rather on the process of work, the control and the leadership of workforce. The first great economist who uses the word "entrepreneur" is the French Richard Cantillon. In his view, the entrepreneur is a speculator.

In the economic thinking of Walras, the employer is the entrepreneur; however, entrepreneurship is not a production factor but rather a function of an agent, for instance the capitalist or the manager. As "marginalism" became the basic paradigm of economics, it is not curious that all the current economics manuals are rich in information with regard to the consumer's behaviour, profit maximization, the wage theory, or the theory of international trade, but are very poor in approaching topics such as technical change, the development of big businesses, the causes of welfare and poverty of nations, and the theory of entrepreneurship (Swedberg, 2000).

The great Austrian economist, Joseph Schumpeter, provides an analysis of entrepreneurial behaviour in his book "The Theory of Economic Development" published in 1911. In this work, the entrepreneurship and its connection with the dynamic incertitude is at the centre of his economic analysis. Schumpeter considers that only technical innovations and dynamic change can produce a positive rate of the profit. He distinguishes between invention and innovation. The main actors of economic life are in the view of Schumpeter: the entrepreneur, the banker, and the owner of production means. The enterprise is the result of a new combination of means of production, when the entrepreneur's function is the realization of this combination. The entrepreneurial success depends on intuition. The entrepreneur is, as Schumpeter very well put it, "a swimmer who swims against the stream" (Swedberg, 2000).

We have to add that, according to American economist Peter Drucker, "Joseph Schumpeter was the only modern important economist who focused on the entrepreneur and his impact on economy. Every economist knows that the entrepreneur is important and has an influence on economy. But for economists the entrepreneurial system is a meta-economic event, something that deeply influences and models economy without being part of it. Economists do not have an explanation of the entrepreneurial phenomenon: why has it risen at the end of 19th century as it is now and it is limited in a country and in a culture. The events which explain why entrepreneurial system becomes efficient are not economic events themselves" (Drucker, 1993).

In an article dedicated to the comparative analysis of the Austrian school and Schumpeter's position with regard to the entrepreneur and entrepreneurship, Alin Croitoru considers that one of the main distinctions between these two

positions is related to the way they analyse the economic environment where entrepreneurial activity takes place (Croitoru, 2013).

One of the main current contributions to the topic of entrepreneurship is the one by Baumol (2009). He considers that the economic advancement of societies such as the United States of America, Ireland, or Israel in comparison with Continental Europe could be explained through the inclination of the mentioned economies towards innovation and entrepreneurship. If the political leaders of a country were to seek the long-term economic growth, they should create the conditions for the entrepreneurial capitalism of big companies.

Which are these conditions? The first condition is connected with the easiness of initiating and developing a business. The second one is the protection against bankruptcy, which is vital for the promotion of entrepreneurship because in its absence many potential entrepreneurs would not assume any risk of initiating a business. The third condition is the access to credit. Baumol quoted two main economists, Amarante and Phelps, who considered that bankers were the channel through which innovations could be transformed from simple ideas into sources of economic growth. Other conditions for stimulating entrepreneurship are the governmental support for research and development, the anti-trust laws, the trading and investment promotion, and rewarding of new ideas (Olah, 2013).

We mentioned earlier that economic sociology has many contributions on the topic of entrepreneurs and entrepreneurship. If the economists are focused on economic factors which favour or inhibit the entrepreneurial activity, then the sociologists are focused on factors such as religion, kinship, ethnicity, social capital, or cultural capital. Maybe the first major contribution that can be regarded is that of Max Weber, who suggested that industrialization and capitalism rose in the West because the values derive from the Protestant Ethic. While in other ages the social and religious ethos inhibited the rational and systematic development, the values derived from the Protestant Ethic encouraged the capitalist behaviour (Olah, 2013).

Mark Granovetter analysed in a book published in 2000 "how is it possible for entrepreneurs to assemble capital and labor required to sustain the cooperative venture we call a firm" (Swedberg, 2000, p. 244). His analysis is focused on the roles played by trust, ethnicity, and kinship, offering a special attention to rotating credit associations from Japan, China, and Southeast Asia. He concludes that discussions on rotating credit associations show that "solidarity required for assembling coherent combinations of economic activity depends on a well-defined collection of people who identify each other as belonging to the same collectivity by ethnicity or even more markers such as place of origin" (Swedberg, 2000, p. 255).

2.2. Rural Entrepreneurship

What represents the rural world?, was asking himself Bogdan Voicu, one of the most gifted Romanian sociologists from the young generation, in a book published in 2006. His answer is pointing to "a fascinating world, where eternity has been born for most of us. A world with unwritten stories, with oral traditions, with hens and sheep… a world of difference for most Western Europeans… a poor world by current standards, but with very rich in understandings and meanings" (Voicu & Voicu 2006, translation by authors).

A somewhat different opinion attempting to take into account the effects of modernization as well is expressed by Eugen Crihan in a recent book. He believes that "the rural is often perceived as the sheer opposite of the urban. There are two major prejudices. The first one is to consider the rural space as a place of historical backwardness (and of course that of conservative-traditionalist mentalities) […] The second one is the identification of the rural with the peasantry…" (Crihan, 2011, p. 15, translation by authors). These two prejudices are hidden under the neutral formula of the urbanization level considered as a synthetic indicator of the development level of every social space. Under this formula, rural is considered a socio-economic situation defined by the existence of many peasants. However, this perception is "without object because the backward and conservative peasant is in a process of extinction following the general trend of modernity" (Crihan, 2011, translation by authors). What definition can we give to rural entrepreneurship? An answer to this question could be: "a force which mobilizes other resources for covering an unsatisfied demand of the market" (Doltu, 2011). There are many cases of successful rural entrepreneurship in countries such as the United States of America, Colombia, Paraguay, or Bulgaria. The diversification of using non-agricultural available resources through the entrepreneurial combinations created diverse forms such as tourism, offering conditions for sport and entertainment or training, small trading, industrial activities, and consultancy or productive activities such as meat, wood, or milk producing (Doltu, 2011).

Why is rural entrepreneurship important for rural development? First of all, it can increase the number of jobs within the agriculture. This increase has several effects: decrease in poverty, increase of income per capita, and higher chances for discouraged workers to come back to the labour market. Rural entrepreneurship has, however, also some potential barriers: the market potential, the low density of population, the small income of the population, the consumption habits, the precarious infrastructure, the lack of entrepreneurial tradition, the low level of education, and the lack of success patterns.

What are the means of encouraging rural entrepreneurship? One possible solution is attracting individuals using marketing techniques and entrepreneur-targeted promotions. A second solution is educational enlargement and

improvement by including applicative disciplines in the educational programmes of the rural high schools and secondary schools. Another possible way of action is to positively influence the attitudes of community leaders towards local entrepreneurs. They could support the significant initiatives from the community and could attract firms from the outside (Doltu, 2011).

To conclude, rural entrepreneurship is an element of what should be today a large perspective of rural development. The rural entrepreneurship is more than providing agricultural credit and creating jobs in fields other than agriculture. All these should be integrated into strategies and programmes of rural development, together with human capital development, infrastructure, and social development (Doltu, 2011).

3. The Romanian Rural Society

Romania was a predominantly rural society until the coming of communism because around 80% of its inhabitants were living in the countryside. Even today, when the country is a member of the European Union, Romania is the country with the highest percentage of rural population (around 45%). It is not by chance, therefore, that Romanian sociology has begun with the study of the rural areas, and thanks to its innovative contributions having its social roots in the Romanian rural reality it has become very well known in the international sociological world. This has become possible due to the prodigious research activity of the Bucharest Sociological School founded by Dimitrie Gusti.

The monographic research initiated by Dimitrie Gusti has been connected with the idea of the cultural development of the rural Romanian world. The research followed by action was in the opinion of Gusti the solution for the socio-economic development of the Romanian villages. The Romanian inter-war village was not only a place of the idyllic landscapes but also one of poverty, illiteracy, and of the illnesses caused by the misery. Even in these circumstances, at the end of the 1930s, there appeared a social segment of the middle classes known as "chiaburii" (kulaks). Unfortunately, these middle-class villagers were one of the "enemies" targeted by the communist power; they embarked on the forced collectivization of the agriculture, which began in 1949 in the southern and eastern regions of Romania and ended in Transylvania in 1962.

Collectivization, thinks Gheorghe Sişeştean – a sociologist and anthropologist from the University of Oradea (a distinguished colleague, who sadly passed away too early) –, represents "the last stage in the process of imposing communism in the Romanian society. To make tens of millions of people shut up was not a process which could be achieved overnight. Firstly, they eliminated the symbols that supported the peasantry: the institution of monarchy, political leaders, and

intellectuals. This process had succeeded by 1949. Then the communist regime could pass on to the building of a new pattern of communist agriculture, a pattern of Soviet inspiration" (Şişeştean, 1999, p. 155, translation by authors). Şişeştean believes that "collectivization meant the end of the traditional village and also the end of peasantry. In this respect, the differences between Western Europe and Eastern Europe are considerable. "In the West, the end of the peasantry occurred through modernization, increase of productivity, and concentration of property, under the effects of the economic law of demand and supply […] In Eastern Europe, the end of peasantry resulted from the imposition by force of an eclectic economic system where elements of modern agriculture lived in symbiosis with techniques of social exploitation and the confiscation of agricultural goods resembling tributary Asian and slavery economic systems" (Şişeştean, 1999, translation by authors).

In the socialist period, the radical transformation of the Romanian rural society through the industrialization and urbanization policies promoted by the Communist regime had as a consequence the decreasing of rural population from 76.6% in 1948 to 45.7% in 1990. The peasantry was subjected to a process of proletarianization. The transformation of the peasant who practised subsistence agriculture into an industrial worker through the programme of massive industrialization started during the leadership of Gheorghe Gheorghiu-Dej and continued in the first two decades of Ceauşescu's era – this was the answer of the communist political regime to the needs of Romania's development. "Even if the industrialization and transformation of the peasantry into working class can be viewed as a necessary process for Romania's economic development, the actions of the communist regime were brutal and destructive for the world of the traditional Romanian village" (Mihalache et al., 2011, translation by authors).

The situation in the Romanian rural world changed dramatically after 1989. The first years of post-socialism witnessed the process of land reform. As a consequence of Law Nr. 18/1991, the agricultural co-operatives of production and state agricultural companies were abolished, and the land was distributed to the former owners within the limit of 10 hectares/family. This law was disputed by people who had possessed large territories before 1949 and were disadvantaged by the limit of 10 hectares. After 1996, the right-wing Romanian government changed the law of 1991 with another one, Law Nr. 169/1997, through which the maximum land size attributed to a family increased from 10 hectares to 50 hectares and from 1 hectare to 30 hectares in the case of the forests (Mihalache & Croitoru, 2011, p. 30). As a consequence of these laws, the Romanian agricultural sector has been transformed from an intensive and export-oriented one into another one, oriented towards self-consumption.

Analysing the situation, Ilie Bădescu considers that "what has happened in the first 8–10 years of transition can be considered as a rural collapse […] The rural population was exposed to a model of transformation characteristic of countries

with rural underdevelopment. It is not about a polarization between the richer and the poorer but about an explosion of the two poles which are characteristic of underdeveloped countries: the employers and those living on subsistence economy" (Bădescu, 2003, p. 36, translated by authors). While the percentage of employees increased with 58.81%, that of the employers increased by 400% and that of the unpaid rural people increased with 716.27%. That is why Ilie Bădescu believes that in this case "polarization is not one of a capitalist type (employer – employee) but one of a new feudal type (employer – the self-subsisting rural)" (Bădescu, 2003, translation by authors).

The rural economy was broken away from the general economy as a consequence of the mentioned land reform laws. The Romanian peasant of the post-socialism reform was forced to rediscover the plough pulled by the donkey (because horses or modern technology were very expensive). Forced to subsistence agriculture and having to witness the state withdrawal from rural economy, the peasant is thrown few historical cycles back into feudal-type agriculture. The conclusion of the analysis is that "the reform which should have brought modernization and market economy brought in fact the ruralization of poverty, social structure disintegration, and rural neo-feudalism" (Bădescu, 2003, translation by authors).

Today, with 15.48 billion Euros as a total value of production, Romania is on the 8th place in the European Union. However, if we focus on agricultural productivity, Romania is overtaken by many countries from South and Eastern Europe such as Poland, Hungary, and Greece. Romania has around 32.3% of the total number of farms of Europe (3.85 million) and from this total the majority is family farms, and only 30,000 are industrial farms. These statistics prove that Romania is practising an agriculture oriented to subsistence. Also, the productivity on hectare is very low. For instance, Romania, which has a productivity of 1,163 euros/hectare, overtakes only countries such as Bulgaria (852 euros/hectare) and Slovakia (1,126 euros/hectare), but it is overtaken by Poland (1,558 euros/hectare), Hungary (1,613 euros/hectare), and Greece (1,874 euros/hectare).[6]

From the point of view of the employed rural population's professional status, the evolution after the 1990s shows us a decrease in the number of employees (between 1996 and 2008, there has been a decrease of 25%) caused by economic post-socialist transition, which also had as an effect the dramatic decrease in industrial activities. The number of rural employees had fallen from 4 million in 1996 to 1.56 million in 2006 (Mihalache & Croitoru, 2011). The economic decrease of 1990–1992 and 1996–1999 resulted in a huge increase of those involved in subsistence agriculture as a life strategy. We have to add that these people are those from the poorest strata of the rural society. The professional status of these

6 "European leaders in agriculture but lagging in productivity," *Adevărul* (Romanian national daily), 24th February, 2015, p. 11.

people could be considered uncertain and they could be called neither farmers nor small entrepreneurs (Mihalache & Croitoru, 2011).

The non-agricultural occupations of the rural population have abruptly decreased after 1990. Before 1990, a significant segment of the active rural population worked in the urban areas, in the industry, the construction sector, and in trading, while work places from the rural localities were predominantly in the agriculture. Commuting between villages and cities (which was a very central phenomenon before 1990) dropped back in the last two decades. Surviving non-agricultural work places are mainly those from the local administration, education, medical assistance, and trade. After 1990, the lack of opportunities at the local level, weak infrastructure, low professional training, and poverty were the main barriers of rural people searching for a workplace outside the agricultural sector. In absolute terms, the current situation of the population from the rural Romanian society who is occupied with non-agricultural activities is close to the levels measured in the 1930s and amounts to around half of the values from the 1970s (Mihalache & Croitoru, 2011).

4. The Hungarian Rural Society

Similarly to Romania, the importance accorded to rural research and development in Hungary in the inter-war period arose from the modernization delay of the society as a whole and the needs derivable from this situation. The backwardness of rural areas has been interpreted by social researchers in the context of the overall transformation of society. Ferenc Erdei, a prominent Hungarian sociologist of the period, regarded rural society an inheritance of the feudal social structure and an obstacle in the process of the country's modernization (Kulcsár, 1983). He insisted on the need to search for solutions which are apt to simultaneously ensure the well-being of the village and the preservation of its traditional identity and values. In setting the theoretical and methodological ground for such an endeavour, the idea of *Sociologia militans* and the monographic method developed within the Bucharest Sociological School led by Dimitrie Gusti have been used as fertile sources of inspiration by Hungarian rural sociologists.

Like in all countries of the region, the hopes and aspirations nurtured by the social reformers were interrupted by the centralist projects of modernization initiated by communist governments. During the 1950s, Hungary, similarly to its neighbours, underwent a Stalinist phase of collectivization, which resulted in a sharp decrease in the rural peasantry's life standards. In the subsequent years, however, under the impact of the popular reactions against the centralist-collectivist agricultural system, the Hungarian communist political leadership developed a new model of collectivized agriculture. The Hungarian agricultural

reform was implemented within the New Economic Mechanism. Initiated in 1968, the Reform offered to agricultural managers the opportunity to work in an economic environment which partially resembled the market conditions: no central plan objectives, a significant degree of autonomous decision-making and internal organization, and competition (Swain, 1992). Among the reform measures, one should mention the increasing of agricultural purchase prices, contract sales instead of compulsory deliveries, the higher wages coming closer to those in industry, and with social security benefits (Swain, 1998).

One of the main outcomes of the economic reform was the "second economy," which appeared earlier in Hungary compared to other countries in Central and Eastern Europe (Stark, 1996; Szelenyi, 1988). Szelenyi (1988) used the term "socialist entrepreneurs" to characterize household production farmers in Hungary in the last two decades of socialism. During this period, the agricultural population enjoyed a relative affluence and job security; therefore, during the regime change of 1989, the agricultural producers were rather reluctant to the idea of radical change.

After 1989, the assets of the co-operative farms were not destroyed or abandoned as in countries such as Bulgaria and Romania (Swain 1998) but were rather transformed into private large-scale successor farms. The transformation from a socialist to a capitalist mode of production was achieved through a sharp downsizing of industrial employment and coincided with a period of economic decline. In the period between 1988 and 1993, agricultural employment fell from 18.5 to 9.9 percent (Kovách, 1994). The share of agriculture within the economy declined from 14 percent to 6 percent of the gross domestic product between 1990 and 1997 (Kocsis, 1999).

The economic restructuring resulted in high unemployment and declining life standards (Szamuely, 1996), but, unlike in several other countries of Central and Eastern Europe, it did not lead to the fragmentation of the lands into small plots (Süli-Zakar et al., 1998). As most industrial working places were located in the cities and towns during socialism, economic downsizing was also most drastic in such places (Brown et al., 2005). During socialism, many of the displaced workers had strong family and community ties with villages (Brown, Schafft, 2002), and to them the decision of migrating back to their villages of origin seemed to be in many respects a natural option. However, only a few of them actually did so due to the fact that rural economy was relatively devoid of opportunities that would be expected to attract the urban unemployed to rural locations (Harcsa et al., 1998). Thus, the urban push was not accompanied by a rural pull. Moreover, rural workers have been adversely affected by diminished commuting possibilities in the nearby urban economies, which have been restructured and required far less labour. Both gross and net migration data indicate that Hungarians were not highly mobile during the early 1990s and that migration increased after 1996 as the economy recovered.

On the other hand, the rural to urban commuting has been an important social phenomenon during post-socialism (Brown et al., 2005). The Hungarian households of today tend to use multiple sources of income, combining jobs in the official economy, the social security benefits, producing for own household consumption, as well as for selling in the market. This livelihood strategy, having its origins in peasant society, was amplified in socialism, and it still persists. The reduction of the social allocations and the increasing economic insecurity and instability are strong incentives for rural inhabitants to produce for their own consumption and/or exchange between households (Brown & Kulcsar, 2001).

5. Entrepreneurial Environment in Romania and Hungary

Although today economic development differences between Romania and Hungary still persist, stronger links have developed between economic firms, public institutions, civil organizations, and university research entities within the Euro-region and steps have been made for strengthening the social and economic cohesion of the border area.

If we take a look at the economic map of Romania and Hungary, we can notice that the development gap and the difference in wages which still exist are of smaller amplitude and are less visible in the shared border region compared to the average situation of the two countries. In Romania, the western-located counties such as Bihor, Cluj, Timiş, alongside the county of Ilfov, which is in the neighbourhood of Bucharest, the capital city, and Constanţa, the main harbour on the Black Sea Coast, are together the most entrepreneurial regions of Romania. On the opposite side, there are the counties in the eastern and southern parts of Romania such as Ialomiţa, Dâmboviţa, Olt, Teleorman, Vaslui, and Botoşani. While the group of the more entrepreneurial counties is composed of those regions where there are important universities or large minority groups and/or very good conditions for economic activities (capital city, main harbour of the country), the low economic and social development of the second group of counties is probably the result of the absence of big universities and lack of large minorities.

Similarly to Romania, in Hungary, there are also important territorial differences concerning the socio-economic development and the characteristics of entrepreneurial environment. The most developed regions, apart from the capital Budapest and its surroundings (with a particularly high number of private entrepreneurs) are the western and south-western parts of the country (especially Győr-Moson-Sopron, Komárom-Esztergom, Csongrád, and Baranya counties), conveniently located geographically for the attraction of foreign capital, while the less developed areas are in the north-east (Szabolcs-Szatmár-Bereg, Békés,

and Nógrád counties).[7] Hajdú-Bihar County is part of the Northern Great Plain Region, which is among the geographical areas with a comparatively weak level of development, a relatively small number of enterprises, and a rather high number of unemployed people. The socio-economic situation is particularly weak in 13 Hajdú-Bihar localities, where the rate of unemployment is more than three times higher as compared to the national average rate.[8]

If we take a look at the statistics regarding entrepreneurial environments, we can notice that Romania and Hungary are very close in the world ranking regarding the ease of doing business, with Romania on a slightly better position. In the next table, we present this comparison for the year of 2013 (in this ranking, there are considered 189 countries from all over the world).

Table 1.

	Romania	**Hungary**
Ease of doing business	48	54
Starting a business	38	57
Dealing with construction permits	140	103
Getting electricity	171	162
Registering property	63	52
Getting credit	7	17
Protecting minority investors	40	110
Paying taxes	52	88
Trading across borders	65	72
Enforcing contracts	51	20
Resolving insolvency	46	64

Source: http://www.doingbusiness.org (accessed on: 20.08.2015)

While in Romania the elements considered to inhibit the entrepreneurial activities are state bureaucracy, corruption, excessive fiscality, and frequent legislation changing (Marinescu et al., 2007), in Hungary, lack of transparency, frequently changing rules and regulation, and overextension of state are considered the inhibitory factors of entrepreneurial activities and economic growth (Csaba, 2011).

6. Research Methodology

What we would like to succeed in our paper is to explain and understand some important issues concerning rural youth involvement in entrepreneurship and agriculture in Romania and Hungary, viewed in a cross-border comparative

7 http://mek.niif.hu/06400/06407/06407.pdf (accessed on: 13.10.2014)
8 rs1.szif.hu/~pmark/publikacio/Netware/koncz.doc (accessed on: 13.10.2014)

perspective. The study is based on the *survey data* collected in the Bihor – Hajdu-Bihar Euro-region during the period of 2012–2013, from a random sample of 1,000 Hungarian and Romanian young villagers. The questionnaire included questions regarding rural youth integration in the labour market, involvement in agriculture and entrepreneurial activities, as well as social and religious participation.

The main questions tackled in this paper are: What does the land mean for young villagers in Romania and Hungary? Do they cultivate the land on large, middle, or small surfaces? What type of crop do they cultivate? What kind of animals do they raise? Do they practise an agriculture oriented to self-consumption or rather one oriented to the market? Are they open towards entrepreneurial activities? Do they have business opportunities? Do Hungarian villagers have a higher degree of modernity than Romanians do?

7. Owning and Cultivating the Land

If we take a look at the surface of the land owned by the subjects and their families (figures 1 and 2), we can notice that in the vast majority of the cases both in Romania and Hungary small terrains or those less than 1 ha are the most prevalent. While in Hungary there are many cases of subjects without land (11.2%), in Romania, there are only few such cases (1%). The subjects that report larger surfaces, between 1 ha and 4 ha, are around 15.7% in Romania and 7.7% in Hungary. In small proportion, there are reported also terrains larger than 4 ha (3.7% in Romania and 4.2% in Hungary).

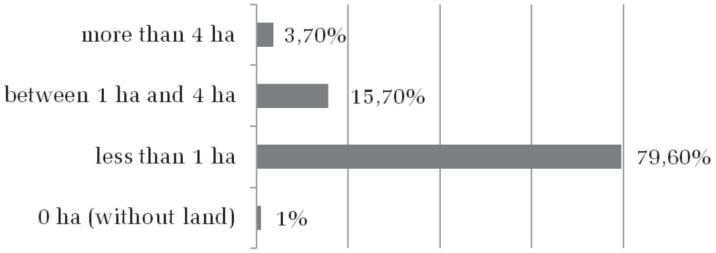

Figure 1. *Surface of land owned by subjects and their families in Romanian villages*

How could we interpret these data? Could we conclude that in this case the Romanian villagers' situation is slightly better than of those in Hungary? First of all, in both countries, the small property dominates in the rural area. We hardly have cases of properties between 10 ha and 50 ha which would be called middle-sized properties. Still, there is an important difference. While in the researched villages from Hungary there are agricultural associations of villagers that cultivate

their lands in common, in the Romanian villages covered by our comparative study, everybody cultivates their land with the family.

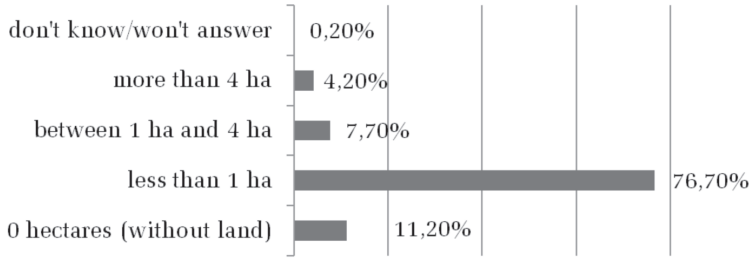

Figure 2. *Surface of land owned by subjects and their families in Hungarian villages*

Two villages from Hungary, Tepe and Konyár, are 30 km distance from Debrecen, the main city of the Hajdú-Bihar County. Derecske is around 20 km distance from Debrecen, while Sáránd and Hosszúpályi are around 15 km distance from the same city. The villages in Romania are either in the neighborhood of the main city, Oradea (no more than 15 km distance – Borş, Nojorid, and Oşorhei), or within a small distance such as Hidişelu de Sus (20 km from Oradea) or even within a greater distance as Vadu Crişului (50 km from Oradea). We think that the fact that in Hungary more subjects reported they had no land denotes a better socio-economic situation of the rural population in Hungary as compared to Romania. These "landless" rural inhabitants are in fact people from the main city of the county, who bought houses in the sub-urban area. In Romania, these cases are less frequent than in Hungary (only 1%). And we can conclude that this process of suburbanization and urban–rural migration – which indicates a modernization of rural society – is more advanced in Hungary.

One of the questions from our survey was: "What does the land mean for you?" As you can see in *Figure 3*, for Hungarians, the land means the main source of living in a higher percentage (27.7%) than in the case of Romanian young villagers (11.1%). A greater percentage of Hungarians (42%) than that of Romanians (8.7%) believes that "even if not profitable, land must be cultivated" (*Figure 4*). Also, the Hungarians (9.3%) are in a higher percentage than Romanians (2.9%) in favour of the idea that "land must not be sold because it represents a fortune that continues to grow" (*Figure 5*).

Could we understand from these figures that Hungarians are more attached to their land and their village than Romanians? We believe that the answer is positive. The explanation could be the fact that most Romanian villages from our sample are closer to the main city of the county than the villages of the Hungarian case. The tendency for migration from rural villages in the Western countries is higher in Hungary than in Romania, and this could be another explanation.

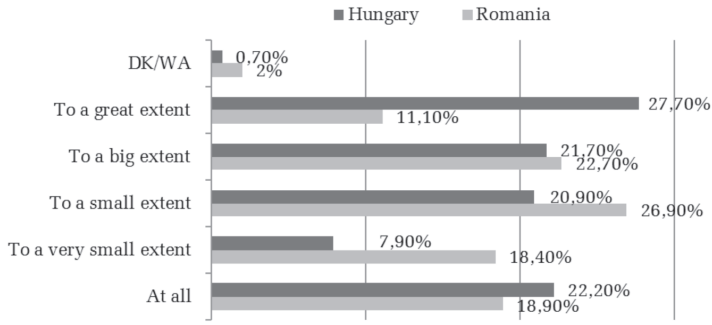

Figure 3. *Land, the main source of living*

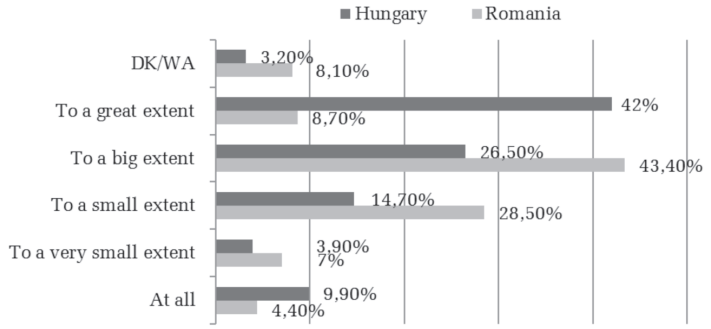

Figure 4. *Even if not profitable, land must be cultivated*

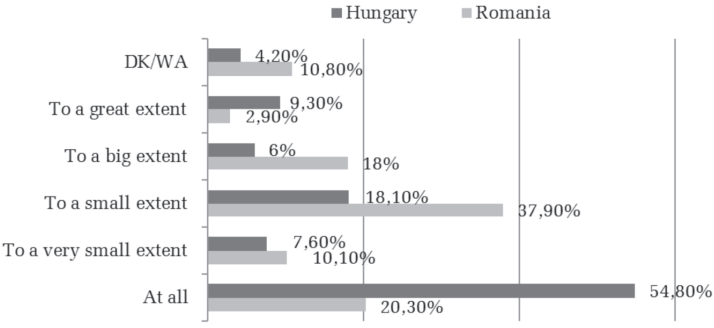

Figure 5. *Land must not be sold; it represents a fortune that continues to grow*

8. Cultivating the Land

As we can notice from the figures 6 and 7, the villagers both in Romania and Hungary cultivate a large variety of crops such as wheat (26.3%), corn (25.1%), and oat (0.80%) in Romania and corn (45.42%), wheat (28%), and sunflower (15.4%) in Hungary. We observe in the Romanian case that there are many cases of villagers who cultivate vegetables (42.8%), while in Hungary the focus is on corn crops. Probably, the statistical results are influenced by the fact that Hungarian agriculture is more oriented to co-operative farms, while in Romania family farms are dominating.

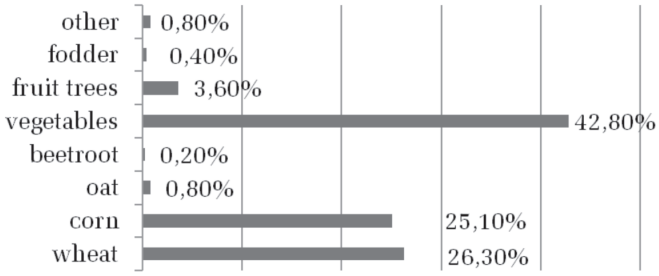

Figure 6. *What are the cultivated crops? The Romanian case*

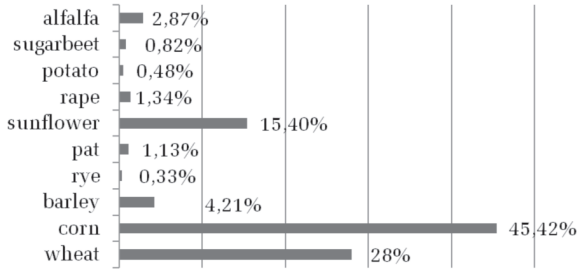

Figure 7. *What are the cultivated crops? The Hungarian case*

But even if there are less young Hungarian villagers who cultivate the land together with their families, there are more Hungarians (12.9%) than Romanians (3.7%) who sell the products on the market (*Figure 10*), a fact which denotes a higher degree of market orientation in the case of Hungarian farmers and a high degree of modernity.

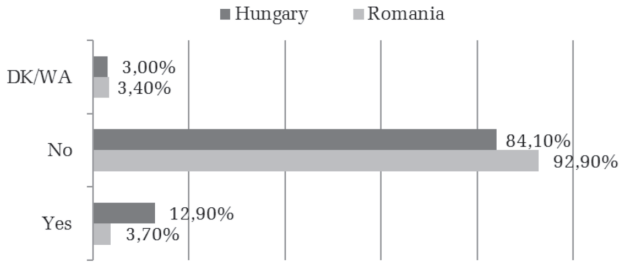

Figure 8. *At present, is your family selling the end products on the market?*

9. Raising Animals

If we take a look at the figures representing animal husbandry, we can figure out that there are more Romanian young villagers (57.7%) who raise animals in comparison with 31.3% of the Hungarians. In Romanian villages, there is a large variety of animals raised (pigs, cattle, poultry, sheep, horses, and rabbits); in Hungarian villages, the young villagers raise only cattle and pigs. This result could also be influenced by the prevalence of co-operative farms in the Hungarian case and by that of the small family farms in the Romanian case.

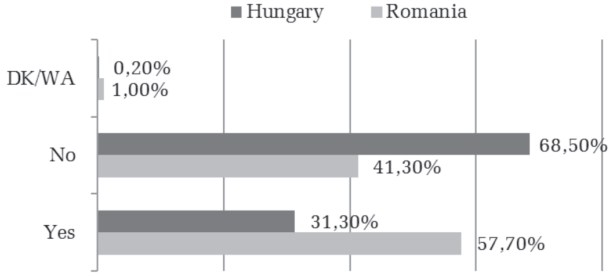

Figure 9. *At present, do you raise animals?*

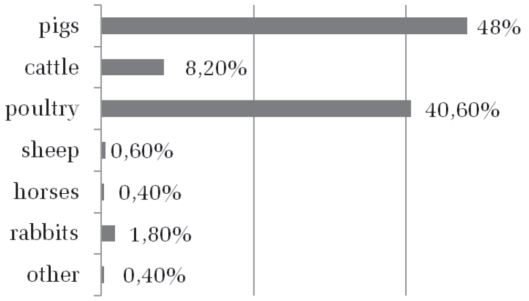

Figure 10. *What kind of animals do you keep? The Romanian case*

Figure 11. What *kind of animals do you keep? The Hungarian case*

Similarly to the case of selling crop end products on the market, the Hungarian villagers are selling animal products on the market in a larger percentage than Romanians do (12.9% compared to 3.7%), which shows that Romanians produce more for self-consumption, while Hungarians practise a market-oriented agriculture to a greater extent. These comparative data point to a higher degree of modernity in the case of Hungarian young rural inhabitants.

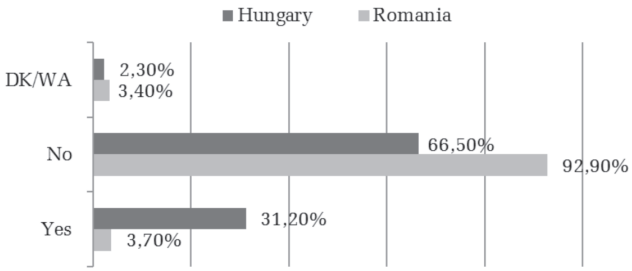

Figure 12. *At present, are you or your family selling animals or animal products on the market?*

10. Entrepreneurship as an Intention and as a Fact

Looking at *Figure 13*, we can notice some interesting aspects. Firstly, as far as the declared intention to open a business is concerned, Romanian young villagers have higher percentages than Hungarians. 77% of the Romanians are in favour of opening a business in comparison with only 55.3% of Hungarians. Similarly, only 18% of Romanians declared they are not in favour of opening a business compared to 38% among the Hungarians. If we look, however, at those who already have a business, Hungarians are in a slightly more favourable position than Romanians.

Concerning business opportunities in the residential area (*Figure 14*), Romanians seem to have better perspectives. 22.8% of Romanian young villagers consider they have very big or big opportunities in comparison with 6.8% in the case of Hungarians. Also, 73% of Hungarians consider they have small or very small opportunities in comparison with 42.7% among the Romanians. Apparently, there is another paradox here. If they have better opportunities, why do Romanians have fewer businesses than Hungarians?

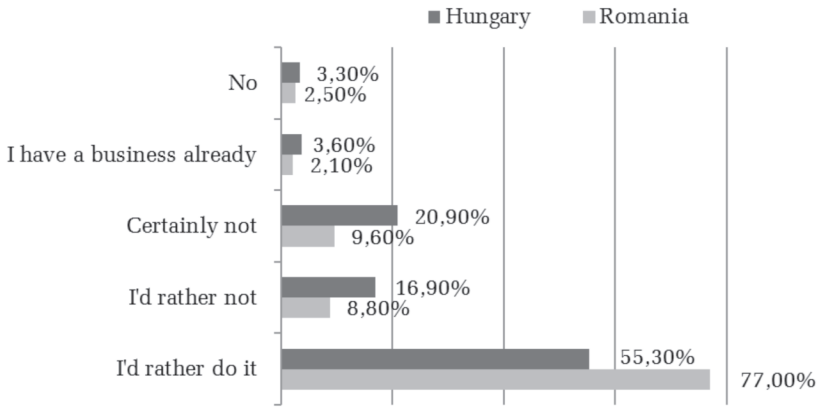

Figure 13. *Would you be willing to open a business of your own?*

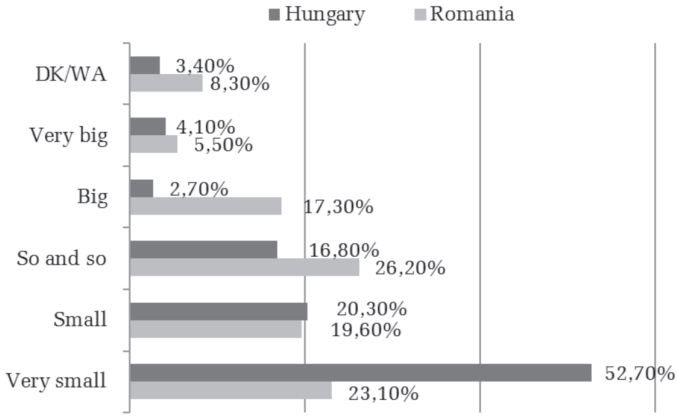

Figure 14. *Business opportunities in the residential area*

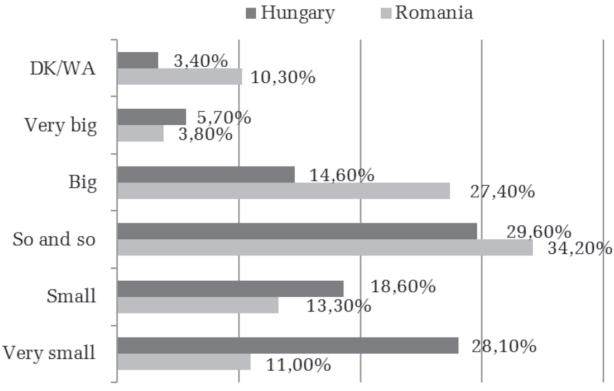

Figure 15. *Business opportunities in the city, in the county*

If we focus on the perceived business opportunities at county and main city level (meaning Debrecen and Oradea), Romanians seem to be more optimistic than Hungarians. 31.2% of Romanians and only 20.3% of Hungarians consider that they have business opportunities in the main city and generally within their own county. Similarly, 46.7% of Hungarians consider that they have small or very small oportunities in comparison with 24.3% of the Romanians.

Thus, our data suggest that even if Hungarian young villagers are not as optimistic as Romanians regarding business opportunities within their own residential area and at county level, in fact, they own a slightly greater number of businesses than Romanians do. This means that although Romanians have a higher score as intentional entrepreneurs, Hungarians are comparatively more successful in actually starting their own businesses. The result is explained by the prevalence of co-operative farms in the Hungarian case, which are oriented in a much higher degree to the market than the small family farms of Romanians are oriented to self-consumption.

11. Conclusions

The idea of this comparative research emerged from the need to integrate the euro-regional outlook and the cross-border approach into the research and development activities within the shared border region of Romania and Hungary. We believe that in order to maximize its efficiency, integrated development should be based on an in-depth knowledge of socio-economic realities, presupposing a set of indicators and the use of a shared methodology of data collection and interpretation. The research instruments developed within the project and applied in a unitary manner in the selected rural communities at both sides of the border permitted us to obtain relevant and comparable information.

Our historical overview points to the fact that the development routes of agriculture and the rural areas in Romania and Hungary present some essentially similar characteristics but also significant differences. Until the epoch of "socialist modernization" in both countries, the rural and agricultural population was the source of living for the great majority of population, but due to its low productivity it could ensure only modest living standards for most families. In spite of the fact that during the inter-war period internationally recognized sociological research initiatives in both countries focused on how to achieve rural and agricultural modernization, no radical breakthrough could be made in this respect before the communist takeover, which – in contrast to the previous gradual reform initiatives – prompted the start of an abrupt and centrally imposed transformation in both societies.

In order to overcome the persisting modernization gap and to consolidate their own social basis, the communist regimes subjected both Romania and Hungary to forced collectivization and industrialization, managing to dislocate a large part of population from the villages to the cities and towns. In only a few decades, the proportion of those living in agriculture dropped sharply and the nature of agricultural work changed radically, putting in fact an end to the traditional peasant way of living. However, after the suppression of the 1956 anti-communist revolution in Hungary, Hungarian and Romanian agriculture experienced rather different paths of development. While in Romania forced collectivization and industrialization continued to aim at the destruction of the spirit of initiative and self-management, which was characteristic to the traditional peasant economy, in Hungary, the communist leadership strived to achieve a kind of new "reconciliation" with the peasantry. Agricultural co-operatives were granted a large degree of autonomy from the central leadership and were permitted to take economically grounded decisions in order to enhance the individual well-being of their members.

After the collapse of the communist regime, re-privatization of the collectivized agricultural farms occurred in both countries, but in rather different conditions and with different consequences, partly derivable from the different realities inherited from the socialist period. In Romania, where collective farms were rightly perceived as another form of state property and of state exploitation of cheap agricultural workforce, most of them were quickly dissolved and replaced by small individual peasant farms bound by their small size and other economic constraints to produce predominantly for subsistence and self-consumption. In contrast, in Hungary, peasants had the opportunity during socialism to experience the advantages of co-operative work in large farms, and therefore the political chances for preserving this more market-oriented form of labour organization in the post-socialist period were much more favorable than in Romania.

These diverging socio-historical conditions – along and in combination with differences in the level of economic development and modernization – should be regarded, in our view, as key explanatory factors of the results of our research, which show that Hungarian young people involved in agriculture are producing to a larger extent for the market, have more entrepreneurial initiatives, and perceive greater opportunities in their own home region as compared to Romanian young villagers. Hungarian rural inhabitants live in a comparatively more consolidated socio-economic environment, which was less affected by discontinuity as compared to the Romanian villages. The Romanian rural world lives in a higher degree of economic uncertainty and has to use to a larger extent compensatory modes of earning an income such as seasonal agricultural work or migrant work abroad. Perhaps the comparatively stronger presence among the researched Romanian young villagers of the intention to start their own business

can be partly explained by the comparatively more precarious living conditions that the local agriculture can offer to local rural inhabitants in Romania.

Perhaps the most viable solutions would require cluster analyses of rural areas due to the fact that there are major demographic and socio-economic differences between these zones. Thus, specific measures need to be taken, adapted to the actual needs and potential of each area (Weingarten, 2004). In this regard, rural typologies can be useful instruments for the design of development policies for rural areas, based on the recognition that the addressed issues are multi-dimensional (Oláh & Pakurár, 2011). Another possibility emphasized in the specialized literature refers to redefining rural development policies based on a new paradigm of rural development by including the concept of network (Murdoch, 2000). Murdoch mentions two network categories: the vertical, which connects the rural to the agriculture and food sectors, and the horizontal, which connects rural spaces to the non-agricultural processes generated by economic changes.

Taking into account the important differences between the socio-economic environments in the two countries outlined above, we think that the potential solutions and strategies of development should be adapted as much as possible to the particular conditions of the two countries and also to the specific circumstances of each individual rural locality. In Hungary, efforts should be made in order to encourage local villagers to assume more risks in taking autonomous life decisions and in trying new opportunities and alternative sources of income. In the case of Romanian young rural inhabitants, the stress in counselling and community building activities should probably be laid mainly on persuading villagers to stay in or to return to their home places, and on assisting them to identify and develop new job opportunities (including entrepreneurial and self-employment solutions) at local level.

In these efforts, stakeholders at local and regional levels should play an essential role. Decentralization of decision-making should be implemented, taking into account that local communities dispose of the best knowledge about the employment needs and opportunities, and the resources within the local community. Local governments, civil organizations, and individual citizens from the two neighbour countries and regions, including the young people themselves, should learn from one another and establish links of co-operation.

The data from our quantitative research convinced us that a qualitative approach that would refine the quantitative data would be necessary for the near future or a next research project. It would be interesting to know the opinions of different local leaders from the villages in the Bihor–Hajdú-Bihar Euro-region regarding the problems such as agriculture, co-operative-farms, individual farms, and entrepreneurship and future opportunities for the rural youth. The research also raises questions regarding the linkage between the economic environment

of the region and entrepreneurial opportunities and activities. Maybe a future research of our team will be dedicated to this topic.

Summary

Our approach is based on the quantitative data analysis. The authors were experts in the mentioned project developed between 2012 and 2013 in Romania and Hungary. Our team collected 1,000 questionnaires using a random sample of young villagers from 10 rural communities of Bihor and Hajdú-Bihar counties.

References

Bădescu, I. (2003). *Țăranii şi noua Europă*. Bucharest: Mica Valahie Publishing House.

Brown, D. L.; Kulcsar, L. (2001). Household economic behavior in post-socialist rural Hungary. *Rural Sociology* June, 66(2). ISSN 0036-0112.

Brown, D; Kulcsár L. J.; Kulcsár L.; Obadovics, C. (2005). Post-socialist restructuring and population redistribution in Hungary. *Rural Sociology* 70(3): 336–359.

Brown, D. L.; K. A. Schafft. (2002). Population deconcentration in Hungary during the post-socialist transformation. *Journal of Rural Studies* 18: 233–244.

Crihan, E. (2011). *Mentalități rurale în România de tranziție. Un studiu de caz în județul Sălaj*. University of Oradea Publishing House.

Croitoru, A. (2013). Digging among the roots of entrepreneurship. *Journal of Community Positive Practices* XIII(1): 129–147.

Csaba, L. (2011). The challenge of growth. *Hungarian Review*, May. Budapest.

Doltu, C. (2011). *Mediul rural între supraviețuire şi oportunități de afaceri*. Bucharest: Expert Publishing House.

Drucker, P. (1993). *Inovația şi sistemul antreprenorial*. Bucharest: Enciclopedica Publishing House.

Harcsa, I.; I. Kovách; Szelényi, I. (1998). The price of privatization: the post-socialist transformational crisis of the Hungarian agricultural system. In: Szelenyi, I. (ed.), *Privatizing the land: rural political economy in post-communist societies*. New York: Routledge. pp. 214–244.

Kocsis, G. (1999). Ten years of hard labor: the rebirth of capitalism. *Hungarian Quarterly* 40: 64–71.

Kovách, I. (1994). Privatization and family farms in Central and Eastern Europe. *Sociologica Ruralis* 39: 369–82.

Kulcsár, K. (1983). Rural development in post-war Hungary. *Sociologia Ruralis* 23(3/4): 7.

Marinescu, C.; Glăvan, B.; Staicu, G; Pană, M.; Jora, O. (2007). *Capitalismul. Logica libertății*. Bucharest: Humanitas Publishing House.

Mihalache, F.; Croitoru, A. (2011). *Mediul rural românesc: evoluții şi involuții. Schimbare socială şi antreprenoriat*. Bucharest: Expert Publishing House.

Murdoch, J. (2000). Networks: a new paradigm for rural development? *Journal of Rural Studies* 16: 407–419.

OECD. 2009. Tackling the jobs crisis. The labour market and social policy response. *OECD Labour and Employment Ministerial Meeting*. Paris: OECD Publishing.

Oláh, J.; Pakurár, M. (2011). The Karcag and Hajdúszoboszló LLS (Hungary): opportunities for, and constraints on, rural economic diversification. *Österreichischen Gesellschaft für Agrarökonomie*, pp. 151–152.

Olah, Ş. (2013). *Oameni şi organizații*. Cluj-Napoca: Eikon Publishing House.

Popescu, R. (2011). *Grupurile vulnerabile şi economia socială. Romi şi femei în dificultate*. Bucharest: Expert Publishing House.

Şişeştean, G. (1999). *Forme tradiționale de viață țărănească*. Zalău: Centrul de Conservare şi Valorificare a Tradiției şi Creației Populare Publishing House.

Süli-Zakar, I.; Sántha, A.; Tykkylainen, M.; Neil, C. (1998). Coping with socialist restructuring and the transition to a market economy in rural Hungary. In: Neil, C.; Tykkylainen, M. (eds), *Local economic development*. New York: United Nations University Press, pp. 125–53.

Stark, D. (1996). Recombinant property forms in Eastern European capitalism. *American Journal of Sociology* 101: 993–1027.

Szelenyi, I. (1988). Socialist entrepreneurs: embourgeoisement in rural Hungary. Madison: University of Wisconsin Press.

Szelenyi, I.; Kostello, E. (1998). Outline of an institutionalist theory of inequality: The case of socialist and postcommunist Eastern Europe. In: Brinton, M. C.; Nee, V. (eds), *The new institutionalism in sociology*. New York: Russell Sage Foundation, pp. 305–326.

Swain, N. (1992). *Hungary: the rise and fall of feasible socialism*. London, pp. 85–151.

Swain N. (1998) A framework for comparing social change in the post-socialist countryside. *Eastern European Countryside* 4: 5–18.

Swedberg, R. (2000). *Entrepreneurship. The social science view*. Oxford University Press.

Szamuely, L. (1996). The social costs of transformation in Central and Eastern Europe. *Hungarian Quarterly* 37: 54–78.

Voicu, M.; Voicu, B. (2006). *Satul românesc pe drumul către Europa*. Iaşi: Polirom Publishing House.

Weingarten, P. et al. (2004). *The Future of rural areas in the CEE new member states*. IAMO, Halle, (http://ec.europa.eu/agriculture/publi/reports/ccrurdev/text_en.pdf, accessed on: 23.09.2013)

"Adevărul" Journal, February 24th, 2015, p. 14 (available on: http://www.adevarul.ro).
http://www.rupri.org/Forms/RuralDefinitionsBrief.pdf. (accessed on: 18.08.2015).
http://www.territorialcooperation.eu/frontpage/show/23625 (accessed on: 25.11.2014).
http://www.capital.ro/somajul-in-randul-tinerilor-a-ajuns-la-257-in-romania.html (accessed on: 3.11.2014).
http://index.hu/chart/2014/09/24/oecd/ (accessed on: 12.10.2014).
http://adlearning.creathink.ro/uploads/publicari/12918_researchstudy%20hu%20jo.pdf (accessed on: 15.09.2014).
http://www.negyedev_munkaero_megyei_2011IIne_hajdu&ei=gcz-VMPxPMa9UaWzhLAN&usg=AFQjCNHuMnfV-RfGbjhfuwIdtlcFP5x5iw&bvm=bv.87611401,d.d24 (accessed on: 29.09.2014).
http://ruralyouthjobs.ro/en/project-prezentation/ (accessed on: 20.10.2014).
http://www.doingbusiness.org (accessed on: 20.08.2015).
http://mek.niif.hu/06400/06407/06407.pdf (accessed on: 13.10.2014).
http://www.rs1.szif.hu/~pmark/publikacio/Netware/koncz.doc (accessed on: 13.10.2014).

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Predicting Customer Churn and Retention Rates in Nigeria's Mobile Telecommunication Industry Using Markov Chain Modelling

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Abstract. The telecommunication industry is one of the service industries that is most affected by the problem of subscribers' churn. Although several techniques have been used to predict customer churn in developed countries, many of those studies used secondary data which are not readily available in Nigeria for researchers. This study investigates how Markov chains help in modelling and predicting the customer churn and retention rate in the Nigerian mobile telecommunication industry. The data generated through the survey were input in the Windows-based Quantitative System for Business (WinQSB) for analysis. The results reveal that in the study area MTN has the highest retention rate (86.11%), followed by GLO (70.51%), Airtel (67%), and Etisalat (67.5%). This result has implications for telecom firms' strategies for competitive advantage in particular and survival in general.

Keywords: Markov chain, customer churn, customer retention, market share, marketing strategies
JEL Classification: C3, C8, M1, M3, L1, L2

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1. Introduction

The study applies Markov chain modelling to predict customers' churn and retention rates in the Nigerian telecommunication industry. The telecommunication industry was chosen for this study owing to the reports that among all industries suffering from customers' churn phenomenon, this industry can be considered as being at the top of the list with an annual rate of approximately 30 percent (see, Kolajo & Adeyemo, 2012; SAS Institute, 2000; Groth, 1999). Kotler and Keller (2006) describe churn as a situation that results in a waste of money and effort, similar to pouring water to a basket or bucket that is leaking. To avoid this scenario in the fast-growing Nigeria telecommunication industry, this study focuses on customers/subscribers of four functioning mobile services providers, namely, Airtel, MTN, Glo Mobile, and Etisalat.

The study introduces a theoretical and practical framework for applying Markov chain analysis to modelling and predicting customers' churn and retention rate in the Nigerian telecommunication industry in both the short run and the long run (i.e. equilibrium). This is done in order to guide the player in the industry as well as understand the trend of churn and retention through subscribers' experience and opinions based on their perception and the use of the services over a given period of time. Thus, this study is unique since there is dearth of extant literature on the application of operation research modelling, especially in the Nigerian business environment. The need for this type of study cannot be overemphasized since business practice in the 21st century does not only need growth but rather a sustainable growth.

Moreover, according to De Bock and Van den Poel (2011), effective churn prediction has a positive impact upon a firm's profitability in several ways. First, identification of potential churning customers allows marketing decision makers to target marketing actions in a cost-effective manner. In the same vein, retention campaigns can be limited to a selection of customers, but they may cover a large proportion of all customers with an actual intention to switch. Second, high customer retention eases the pressure to attract a substantial number of new customers in every period. Studies have shown that the acquisition of new customers generally comes at a cost higher than keeping and satisfying the existing customer base (Reinartz and Kumar, 2003). Thus, customer acquisition and retention is a major concern for all industries. However, it is particularly strong in the highly competitive markets where many players (network providers) are competing for the same customers/subscribers with the implementation of mobile number portability (MNP) in a broadly liberalized telecommunications industry such as the Nigerian market.

In light of the above discussion, this study empirically presents an application of Markov chains to churn and retention analysis in order to guide effective

decision-making and policy recommendations for sustainable growth in the industry. The outcome of this research effort provides telecommunication operators, vendors, the regulatory body, and other relevant establishments with strategies to manage customer churn and retention in the Nigerian market. In a considerable way too, the study would add to the existing literature on prediction of customers' churn and retention decisions. Thus, the main objective of this study is to examine the use of Markov chain modelling for customers' churn and retention rates prediction in the Nigerian telecommunication industry. The study is unique, since the data were collected from subscribers who churn or retain network subscriber identification module (SIM) instead of working on telecommunication firms' secondary data.

The next section presents the literature on the adaptation of Markov chain modelling to predicting customer churn and retention rates in the telecommunication industry. Section 3 presents the research methods for modelling primary data from subscribers through Markov chains. Section 4 describes the results of the data analysis. Section 5 presents the conclusions and the implications of the study for stakeholders.

2. Literature Review

2.1. Markov Chain Modelling

2.1.1 Development of Markov Chain

Markov modelling as a form of stochastic modelling is used for describing the process of sequence of probable transitions between states. In the present study, with four major GSM players (MTN, Airtel, Globacom, and Etisalat) in the Nigerian telecommunication industry, a subscriber will always prefer most a particular service provider at a particular time based on the setting and services provided and may shift his/her preference in the next period. The shift of preferences by an individual subscriber can be described as a sequence of certain states of satisfaction or otherwise with service providers (Beck and Pauker, 1983). A Markovian stochastic process has the memory-less property, which means that the future state can be predicted from the knowledge of the present state. This means that customer service experience at a particular time will highly influence the possible future state(s) of the customer and the decisions to be taken by him/her about the service providers. The decision to churn or retain any network provider is determined mostly on the knowledge of subscribers about the efficiency of a given service provider as concerns effective mobile communication. This feature is an essential property of the Markov processes (Norris, 1997).

Markov chain models are particularly useful in business management and especially in marketing as a major functional area of any business organization. They are concerned with problems of customers' movement, both in terms of movement from one competitor to another and from one "state" to another. "State," in this context, may refer to the size/class of expenditure on a particular network provider (in terms of recharges), increasing or reducing the cost expended on rival service provider, termination of contract with a service provider, referral, or some other variables (Oyatoye, Adebiyi, and Amole, 2015). The present study is unique by exploring primary data on customers' churn and retention decision in the Nigerian telecommunication industry. Unlike the study by Oyatoye, Adebiyi, and Amole, (2015), which uses Gauss-Jordan elimination, this study uses Markov chains for modelling and analysis with the aid of WinQSB.

Markov chain models provide a useful conceptual method for analysing the changes generated by the variation of such variables. In some cases, they can also be used to predict future values (churn/market share prediction). Markov chain models, therefore, are valuable both in the study of customer churn/porting/defection (switching of preference) and in retention. They can also be used for predicting customer movement (defection) or the market share forecast/rate of change that aid growth and development of telecommunication industry in Nigeria. In this regard, its aim is to determine what sort of service provider tends to increase in size and which are declining due to or compelled by the customer changes and directions (Collins, 1975).

This paper employs first-order Markov chains to analyse the survey data collected to obtain information about movement or the switching of subscribers as well as the market share of the network providers in the study area. First-order Markov chains probabilities of states depend only on the most recent states of the chain. Therefore, the Markov chain considered in the paper satisfies the following properties (Sharma, 2009; Ezugwu, Olugun, and Anieting, 2013):

(i) There are finite numbers of possible states: each subscriber can prefer most any of the four GSM network providers at any point in time. In this case, there is no fifth GSM service provider during the period of data collection for this study (that is, there is a limited number of GSM network operators).

(ii) States are both collectively exhaustive and mutually exclusive: the network providers listed assumed that no subscriber can prefer most the services of two network providers at any point in time. That is, a network provider can be preferred more than the other at any point in time, even in cases of multiple SIMs or phone users. The rate or frequency at which customers recharge each of the SIMs can be used to distinguish their preferences, since cost spent on SIM is important to network providers, being the major source of revenue to them.

(iii) The transition probabilities depend only on the current state of the system: If the current state is known, the conditional probability of the next state is

independent of the states prior to the present state; that a subscriber will move to another service provider depends only on how he/she perceives the services received at present from the network provider(s) he or she currently patronizes.

(iv) The long-run probability of being in a particular state will be constant over time: subscribers seem to stay with a network provider for a long time.

(v) The transition probabilities of moving to alternative states in the next time period must sum to 1.0. Since the network providers are not more than four and the preferences of subscribers can only shuffle among them, the transition probabilities of moving to an alternative state in the next period will always sum to one.

2.1.2. Discrete-Time Markov Chain

We consider a time-homogenous model, that is, a model in which the transition probabilities are constant over time. The transition probability matrix $\mathbf{P}(t)$ contains the probabilities for the transitions. The rows of the matrix represent the most preferred network provider, while the columns stand for the future state (which they may churn to). The probabilities are denoted $\mathbf{p}_{ij}$, and for each row i and column j they represent the probability of moving from state i to state j.

$$P = \begin{array}{l} \\ MTN \\ AIRTEL \\ GLO \\ ETISALAT \end{array} \begin{array}{c} \begin{array}{cccc} MTN & AIRTEL & GLO & ETISALAT \end{array} \\ \begin{pmatrix} p_{11} & p_{12} & p_{13} & p_{14} \\ p_{21} & p_{22} & p_{23} & p_{24} \\ p_{31} & p_{32} & p_{33} & p_{34} \\ p_{41} & p_{42} & p_{43} & p_{44} \end{pmatrix} \end{array} \begin{array}{l} \\ 1 \\ 2 \\ 3 \\ 4 \end{array}$$

Figure 2.1. *Transition probability matrix for a time-homogeneous 4-state Markov model of mobile telecommunication service providers in Nigeria.*

The sum of the row probabilities equals one since each preferred network (state) is independent of the other and a subscriber may switch/churn/move to any of the four states depending on his/her motivation for churn or retention drivers. The diagonals represent the probability of staying with or maintaining a particular network provider over time. A state is called absorbing when the probability of leaving the state is zero. For example, if the subscriber is dead or misplaces his/her SIMs without reactivation, then it is an absorbing state (non-active lines).

A fir*st-order Markov process* in discrete time is a stochastic process X_t, t = 1, 2, … for which the following holds:

$$P\,(X_{t+1} = x_{t+1} / X_t = x_t, \ldots, X_1 = x_1) = P(X_{t+1} = x_{t+1} / X_t = x_t).$$

In other words, only the present determines the future, the past is irrelevant.

3. Research Methods

The study is a cross-sectional survey research of four global systems for mobile communication (GSM) subscribers in Lagos State. The sample includes subscribers who had churned from their network provider after the MNP implementation in April 2013. The MNP implementation period was used as the benchmark owing to the fact that this is the period that should still stimulate the most competition among the network service providers in any economy where this telecommunication is implemented.

The questionnaire was administered to four hundred and eighty subscribers in Lagos State, while only four hundred and eight copies of the questionnaire administered were filled properly and used for the Markov chain analysis. The data collected through a survey was transformed to transition probabilities matrix, which is amenable to Markov chain analysis. The assumptions, definition of notations, variables, parameters, and probabilities guiding this study are presented below.

Markov Model Assumptions for Mobile Telecommunication Customers' Churn and Retention Prediction Rates

Due to the condition of multiple SIM subscribers in Nigeria, mobile phone users do not necessarily port by leaving a particular network provider for another, but they combine SIMs of network providers because some mobile phones combine two, three, or even four SIMs, while some subscribers are comfortable with carrying about multiple phones (Oyatoye, Adebiyi, and Amole, 2015). Moreover, the cost of purchasing a SIM card, which was very high when GSM was introduced fourteen years ago (in 2001), has gone substantially down and is approaching zero naira.

Therefore, churning by mobile telecommunication subscribers is more of a switching their preference from a service provider to another among the multiple SIMs held. It mostly occurs when subscribers do not recharge or use a particular SIM but keep it, and they recharge that of the competitors. The Markov chain model adopted for customer churn and retention in this study is based on the following assumptions:

(i) There is a limited number of possible states since there is a limited number of GSM operators in Nigeria as at the time of this study, namely; MTN, Airtel, GLO, and Etisalat.

(ii) States are both collectively exhaustive and mutually exclusive. There is always a most preferred network, and they are mutually exclusive. That is to say, among the multiple SIMs that subscribers hold or that are on the market at a particular time, there is always a most preferred one in terms of meeting the telecommunication needs of subscribers, over other network providers.

(iii) The transition probabilities of moving from one state to another depend only on the current state of the system.

(iv) The long-run probability of being in a particular state will be constant over time. This assumption is based on the theory that in the long run, mobile telecommunication operators would learn a lesson as to holding certain factors responsible for subscriber churn right in order to maintain a steady patronage and retain profitable subscribers.

(v) The transition probabilities of churning to alternative states (other GSM operators) in the next period, given the current period, would sum up to unity (1.0).

Definition of Notations

Let S_i denote the preference (state) i, where i = M, A, G, E, the current GSM operator that a subscriber prefers most at a particular time;

Letter M is used to represent MTN.

Letter A is used to represent Airtel.

Letter G is used to represent Globacom.

Letter E is used to represent Etisalat.

P represents the transition probability matrix;

Π_{it} signifies the proportion of market share controlled by GSM operator i in period t;

Π_{i0} represents the initial market share of GSM operator i in period 0.

Given the above definition, the proportion of market share controlled by the operators initially is:

$\Pi = (\Pi_{M0,} \Pi_{A0}, \Pi_{G0,} \Pi_{E0})$.

Definition of Probabilities

p_{ij} denotes the probability that a subscriber who currently preferred a mobile telecommunication operator i (i = M, A, G, E) churns to another operator j (j = M, A, G, E) in the next period of time. By this definition, when i = j, we mean that the subscriber is not churning to an alternative operator, thus retaining the network service provider and continuing the patronage.

The Model (Transition Probability Matrix, P)

The transition probability matrix, P, of the churn/retention tendencies of GSM subscribers in its abstract form is presented as:

$$P = \begin{array}{c} \\ S_M \\ S_A \\ S_G \\ S_E \end{array} \begin{array}{c} \begin{array}{cccc} S_M & S_A & S_G & S_E \end{array} \\ \begin{pmatrix} p_{MM} & p_{MA} & p_{MG} & p_{ME} \\ p_{AM} & p_{AA} & p_{AG} & p_{AE} \\ p_{GM} & p_{GA} & p_{GG} & p_{GE} \\ p_{EM} & p_{EA} & p_{EG} & p_{EE} \end{pmatrix} \end{array}$$

Figure 3.1. *Model for subscribers' churn and retention among mobile telecommunication network operators.*

4. Results and Discussion

To achieve the main objective (assess the use of Markov chain model for customers' churn and retention rates prediction in the Nigerian mobile telecommunication industry) of the research problem, the data collected was cross-tabulated in *Table 4.1*. It reveals the preferences of the respondents in the study area to GSM network operators in Nigeria. The result from the cross-tabulation was structured to suit the Markov Chain model.

Table 4.1. *Cross-tabulation output*

		To				
		MTN	**Airtel**	**Glo**	**Etisalat**	**Total**
From	**MTN**	124	9	7	4	144
	Airtel	22	71	9	4	106
	Glo	13	8	55	2	78
	Etisalat	13	7	6	54	80
Total		**172**	**95**	**77**	**64**	**408**

Table 4.1 shows data collated from a carefully designed questionnaire aimed at understanding subscribers' behaviour in relation to the network SIM(s) they are using and the most preferred one as at the time when MNP was implemented in Nigeria. Out of the 144 subscribers that preferred MTN the most before MNP implementation, 20 show preference for other three network operators. Some 35 subscribers preferred moving from Airtel network to others, 23 from Glo, while 26 out of 80 moved to other network operators from Etisalat.

The data in *Table 4.1* was used in generating a transition matrix, which is adaptable to the Markov chain modelling and analysis. In order to predict the movement of the system from one state to the next, it is necessary to know the conditional or transitional probabilities of such a movement. Thus, the data in *Table 4.1* was transformed to arrive at the probability transition matrix through *Table 4.2 to 4.6.* The transition probability matrix enables us to predict the future

states (market share). It helps to arrive at the probability value for the churn and retention of various network providers both in the short run and at a steady-state equilibrium.

Table 4.2. *Initial table of subscribers' preference for network providers*

Number of subscribers	Network	S_M	S_A	S_G	S_E
144	S_M	124	09	07	04
106	S_A	22	71	09	04
78	S_G	13	08	55	02
80	S_E	13	07	06	54

Source: Survey 2014

Table 4.3. *Gain and loss immediately after MNP was implemented in April 2013*

Network	Number of subscribers	Gain	Loss	Number of subscribers
S_M	144	48	20	172
S_A	106	24	35	95
S_G	78	22	23	77
S_E	80	10	26	64

Table 4.4. *Gains from and losses to (customers' preference of switching)*

Telecom operators	Number of subscribers	Losses to				Gains from				Total subscribers
		S_M	S_A	S_G	S_E	S_M	S_A	S_G	S_E	
S_M	144	0	09	07	04	0	22	13	13	172
S_A	106	22	0	09	04	09	0	08	07	95
S_G	78	13	08	0	02	07	09	0	06	77
S_E	80	13	07	06	0	04	04	02	0	64
										408

Table 4.5. *Retention probabilities*

Telecoms providers	Number of customers before MNP	Number of customers lost	Number of customers retained	Probability of retention
S_M	144	20	124	$144 - \frac{20}{144} = 0.8611$
S_A	106	35	71	$106 - \frac{35}{106} = 0.6698$

Telecoms providers	Number of customers before MNP	Number of customers lost	Number of customers retained	Probability of retention
S_G	78	23	55	$78 - \frac{23}{78} = 0.7051$
S_E	80	26	54	$80 - \frac{26}{80} = 0.675$

Table 4.6. *Probabilities associated with gains and losses of customers*
Probabilities of gains and losses (row = gains and column = losses)

Number of subscribers	From				
	Network	S_M	S_A	S_G	S_E
144	S_M	$\frac{0}{144} = 0$	$\frac{22}{106} = 0.20755$	$\frac{13}{78} = 0.1667$	$\frac{13}{80} = 0.1625$
106	S_A	$\frac{9}{144} = 0.0625$	$\frac{0}{106} = 0$	$\frac{8}{78} = 0.1025$	$\frac{7}{80} = 0.0875$
78	S_G	$\frac{7}{144} = 0.0486$	$\frac{9}{106} = 0.08491$	$\frac{0}{78} = 0$	$\frac{6}{80} = 0.075$
80	S_E	$\frac{4}{144} = 0.0278$	$\frac{4}{106} = 0.03774$	$\frac{2}{78} = 0.0256$	$\frac{0}{80} = 0$

The probability of gains and losses among mobile telecommunication network providers in Nigeria after mobile number portability (MNP) implementation

$$\begin{array}{c} \\ S_M \\ S_A \\ S_G \\ S_E \end{array} \begin{array}{c} \begin{array}{cccc} S_M & S_A & S_G & S_E \end{array} \\ \begin{pmatrix} 0 & 0.20755 & 0.1667 & 0.1625 \\ 0.0625 & 0 & 0.1025 & 0.0875 \\ 0.0486 & 0.08491 & 0 & 0.075 \\ 0.0278 & 0.03774 & 0.0256 & 0 \end{pmatrix} \end{array}$$

Where the $P_{ij} = 0$ indicates that no transition from state i to state j. Thus, the retention value of preferring a network provider in the next period is shown in Figure 4.1.

The Transition Probability Matrix

$$\begin{array}{c} \\ S_M \\ S_A \\ S_G \\ S_E \end{array} \begin{array}{c} \begin{array}{cccc} S_M & S_A & S_G & S_E \end{array} \\ \begin{pmatrix} 0.8611 & 0.20755 & 0.1667 & 0.1625 \\ 0.0625 & 0.6698 & 0.1025 & 0.0875 \\ 0.0486 & 0.08491 & 0.7051 & 0.0750 \\ 0.0278 & 0.03774 & 0.0256 & 0.6750 \end{pmatrix} \end{array}$$

Figure 4.1. *Transition probability matrix for customer churn and retention.*

The diagonal figures in the probability matrix represent the ability of each network provider to retain the present subscribers in the next period of customer transition. Thus, it reveals that MTN has the highest retention rate of 86.11 percent, followed by GLO (70.51%), Airtel (66.98%), and Etisalat (67.5%). This equally represents the number of mobile phone telecommunication customers of each network provider in the first six months when MNP was implemented, which is set as a benchmark to assess the churning behaviour of subscribers in the study area (144 + 106 + 78 + 80 = 408 subscribers). The percentage share of the operators at the initial stage is computed as:

$$\text{MTN} = \frac{144}{408} = 0.3529 \qquad \text{Airtel} = \frac{106}{408} = 0.2598$$

$$\text{Glo} = \frac{78}{408} = 0.1912 \qquad \text{Etisalat} = \frac{80}{408} = 0.1961$$

The initial market shares (vectors) of each network provider as at the launch of MNP implementation in the study area are: MTN = 0.3529, Airtel = 0.2598, Glo = 0.1912, Etisalat = 0.1961. Thus, the vector was used to multiply the transition probability matrix as shown below in order to obtain the market shares of the network providers at the beginning of the second period.

$$\begin{pmatrix} S_M & S_A & S_G & S_E \\ 0.3529 & 0.2598 & 0.1912 & 0.1961 \end{pmatrix} \begin{Bmatrix} 0.8611 & 0.20755 & 0.1667 & 0.1625 \\ 0.0625 & 0.6698 & 0.1026 & 0.0875 \\ 0.0486 & 0.08491 & 0.7051 & 0.0750 \\ 0.0278 & 0.03774 & 0.0256 & 0.6750 \end{Bmatrix}$$

The data was input in the Windows-based Quantitative System for Business (WinQSB). The windows interface has a column for the number of state and the name of the problem to be solved. The problem is the prediction of customer churn and retention rate in the Nigerian mobile telecommunication industry, while the states are four in number (MTN, Airtel, Glo, and Etisalat). Period one was the subscribers' preferences output of churn and retention rates for each mobile telecommunication network service provider after the implementation of mobile number portability in Nigeria (May 2013 to October 2013).

Table 4.7. *Possible outcomes in the following period(s)*

Time (every six months)	MTN	Airtel	Glo	Etisalat
Period 1	0.421504	0.232898	0.188731	0.156867
Period 2	0.468212	0.215475	0.185097	0.131215
Period 3	0.500045	0.204104	0.181402	0.11448
Period 4	0.521758	0.196629	0.178124	0.103492
Period 5	0.536576	0.191682	0.175406	0.096335
Period 6	0.546695	0.188389	0.173255	0.091660

Time (every six months)	MTN	Airtel	Glo	Etisalat
Period 7	0.553607	0.186185	0.171600	0.088606
Period 8	0.558330	0.184704	0.170353	0.086611
Period 9	0.561558	0.183704	0.169428	0.085308
Period 10	0.563764	0.183027	0.168750	0.084457
Period 11	0.565272	0.182567	0.168258	0.083901
Period 12	0.566303	0.182254	0.167903	0.083538
Period 13	0.567007	0.182254	0.167903	0.083301
Period 14	0.567488	0.181895	0.167469	0.083146
Period 15	0.567817	0.181795	0.167341	0.083044
Period 16	0.568042	0.181727	0.167251	0.082978
Period 17	0.568196	0.1816800	0.167187	0.082934

The results suggest that the market share in the study area will continue to increase after a successful period (six months) for MTN, up to 56%, while that of Airtel will decrease to 18%, Glo to 16%, and Etisalat to 8.5% in Period 9 after the implementation of mobile number portability in Nigeria. Where the changes in the successful transition were not significant, we solved for a steady-state equilibrium. This result reveals that the majority of the subscribers in the study area are likely to churn to MTN, thereby maintaining the market leadership for a long time, unless other network providers evolve appropriate strategies to win more customers and retain them.

In addition, the market share difference between Airtel and Glo may be bridged depending on the strategies used by any of the operators that set to achieve such in the future, as it may not be enough to have an edge but the ability to sustain it over time is also necessary. Since we are in the era of sustainable competitive advantage, each network operator in the market is implored to look inward to their core competencies and capabilities in order to enhance sustainable growth of the firm.

In determining the market share of telecommunication operators at steady-state equilibrium, the transition probability matrix computed from the survey, as shown previously in *Table 4.7,* was used for computing the steady-state vector (unknown). The steady-state equilibrium is a state where further changes in the probability value for the market share of each of the telecom operators will become insignificant (Sharma, 2009).

Therefore, WinQSB was used for solving the equations obtained in order to determine the values for the unknown variables – as a result of equating the parameters of the variables at the present state to be the same for the future state, that is, $(\Pi_{Mt,} \Pi_{At,} \Pi_{Gt,} \Pi_{Et}) = (\Pi_{Mi,} \Pi_{Ai,} \Pi_{Gi,} \Pi_{Ei}) P$ at the steady state (Period 33).

We arrived at values for the market share at equilibrium (as "t" increases) by solving a set of simultaneous equations given by:

$(\Pi_{Mt,} \Pi_{At} \Pi_{Gt,} \Pi_{Et}) = (\Pi_{Mi,} \Pi_{Ai,} \Pi_{Gi,} \Pi_{Ei})$ P, where, P is the transition matrix.

Dropping the second subscript on both sides gives:

0.8611M + 0.0625A + 0.0486G + 0.0278E ..... (i)
0.2074M + 0. 6698A + 0.0849G + 0.0377E ..... (ii)
0.1667M + 0.1026A + 0.7051G + 0.0256E ..... (iii)
0.1625M + 0.0875A + 0.075G + 0.675E ..... (iv)
M + A + G + E = 1 ..... (v)

The results obtained from the window interface of the WinQSB for unknown variables are: $\Pi_M = 0.568528$, $\Pi_A = 0.1815790$, $\Pi_G = 0.167041$, and $\Pi_E = 0.082852$. These were realized based on the data processed for the study area, using the Markov model. MTN presents an ascending trend in market share while others present a descending trend. Thus, there is need for caution in order to prevent a single operator from dominating more than 50% of the entire market share in the future. This shows that if the current developments in the industry persevere for a long time, the percentage market share of each operator will remain unchanged, unless far-reaching efforts are made by other operators to sustain and increase the rate of acquisition from subscribers' churning behaviour in the mobile telecommunication industry.

5. Conclusions and Implications

From the survey of the customer preference of the four operators, the initial market share vector was calculated. Using the responses of subscribers on their churn and retention possibilities, a Markov chain model was developed. Findings from the model analyses showed that MTN will maintain its leadership in the telecom industry up to the steady-state point. Other operators in the industry need to re-examine their retention strategies to be able to meet customers' needs so as to reverse the downward trend of their market share. Similarly, the churn among subscribers to operators was observed to stabilize in the ninth period, provided there is no new entrant (mobile service provider) into the industry by 2017. Thus, an average subscriber will remain with one of the existing four operators.

The Markov model was found suitable in modelling customer churn and retention both in the short run and at equilibrium state. The study enriched the operations' research and marketing literature by providing empirical evidence on the application of the Markov chain model to customers' churn and retention decision in the Nigerian telecommunication industry. Thus, the results obtained have implications for the telecom firms' strategies for competitive advantage in particular and for survival in general.

The results gave insight into customers' movements among the service providers in the industry, thereby indicating ways to formulate appropriate marketing and organizational strategies for survival. The model developed in this study could also be adapted to any service industry where the churn and retention of customers is at stake, in order to be able to predict appropriately customers' churn and retention rate, which is the bedrock of good marketing strategies for any organization.

References

Beck, J. R.; Pauker, S. G. (1983). The Markov process in medical prognosis. *Medical Decision Making* 3: 419–458.

Collins, L. (1975). *An Introduction to Markov Chain Analysis*. Ashford Kent and London: Headley. Brothers Ltd., The Invicta Press.

De Bock, K. W; D., Van den Poel. (2011). An empirical evaluation of rotation-based ensemble classifiers for customer churn prediction. *Expert Systems with Applications* 38(10): 12293–12301.

Ezugwu, V. O.; Olugun, S.; Anieting, A. E. (2013). Markov chain: a stabilizer to market equilibrium mix. *International Journal of Advanced Scientific and Technical Research,* 3(1): 565–575.

Groth, R. (1999). *Data mining: building competitive advantage*. Santa Clara, CA: Prentice Hall.

Kolajo, T.; Adeyemo, A. B. (2012). Data mining technique for predicting telecommunications industry customer churn using both descriptive and predictive algorithms. *Computing Information Systems & Development Informatics Journal* 3(2): 27–34.

Kotler, P.; Keller. L. (2006). *Marketing Management.* 12th ed. New Jersey: Pearson Prentice Hall.

Norris, J. R. (1997). *Markov chains*. Cambridge: Cambridge University Press.

Oyatoye, E. O.; Adebiyi, S. O.; Amole. B. B. (2015). Modeling switching behaviour of Nigeria global system for mobile communication multiple SIMs subscribers' using Markov chain analysis. *The IUP Journal of Operations Management* 14(1): 7–31.

Reinartz, W. J.; Kumar, V. (2003). The impact of customer relationship characteristics on profitable lifetime duration. *Journal of Marketing* 67(1): 77–99.

SAS Institute. (2000). *Best Practice in Churn Prediction*. A SAS Institute White Paper.

Sharma, J. K. (2009). *Operations research; theory and applications*. 3rd ed. India: Macmillan Ltd.

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Businesses and Their Attitudes to Frugal Innovation

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Abstract. In order to maintain and increase their market share and position in competition, businesses have to adapt to the changes of the environment and they have to innovate. Since the latest economic crisis, Hungarian businesses have been struggling with several problems, particularly the scarcity of both resources and demands. These circumstances lead to the issues of frugal innovation and sustainable development. The aim of this paper is to show the results of a survey on attitudes toward frugal innovation, which was conducted among 216 Hungarian enterprises in the spring of 2015. However, the surveyed businesses are striving to stay in competition in a not too favourable economic environment as most of them have not recognized the chance of frugal innovation.

Keywords: frugal innovation, Hungarian businesses, sustainability
JEL Classification: O35

1. Introduction

Among several other new challenges for businesses in the 21st century, particularly important requirements are: cost-effective management with resources, sustainable development, and globalization. Csath (2015) evaluates the latest IMF report about Hungary (2015), and his main point is that in Hungary the GDP has not reached the level we had before the economic crisis. The most important tasks aimed to boost competitiveness are: (i) diversifying the economic structure, which means increasing SMEs; (ii) moving from assemble work to create higher added value; (iii) more innovation that creates new jobs with higher qualifications and increases productivity. But a few conditions for sustainable development in Hungary are

lacking. The issue of the environmental problems of the 1970s called for the notions of sustainable development and social responsibility. According to the United Nations World Commission on Environment and Development, sustainable development means "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". In terms of the triple bottom line, there is environmental, societal, and economic sustainability (Tóth, 2007). The problem is a strong reductionism in business practice, where environmental sustainability is taken to mean eco-efficiency, societal sustainability is confused with insisting on principles such as the improvement of work conditions, and economic sustainability is identified as profitable, long-term competitiveness (Tóth, 2007, p. 23). The practice of frugal innovation is regularly connected to emerging economies, particularly to India, and involves innovation under conditions of scarcity (Srinivas & Sutz, 2008; Balkrishna, 2014). According to Berm and Ivens (2013), local governments in countries such as China, India, Russia, and Brazil emphasize their political concern about companies, sustainability management, and managerial attention. Based on Zeschky et al. (2011), it is obvious that a number of innovations stem from emerging economies, particularly the subsidiaries of multinational companies. Fukuda and Watanabe (2011, p. 95) emphasize that frugality is "a key to new functionality satisfying local demand of people in growing economies. [..] Frugality would trigger the shift from an autarky cycle between the consumption and GDP increases, to investment driven development."

There is an important and exciting question: How are businesses and particularly small- and medium-sized companies able to operate and innovate in difficult situations like that described above? The answer would be a frugal innovation, based on, among others, frugality or scarcity of resources. But the realization of innovation – like several other business activities – highly needs the positive attitudes of businesses. The aim of this paper is to examine these attitudes among Hungarian enterprises. The added value of the present paper is the analysis of the importance of frugal innovation and the feasibility of frugal innovation among Hungarian businesses.

The next section of the present paper deals with the definitions, essence, and characteristics of frugal innovation. The third section describes the materials and methods of our primary survey. Data and analyses can be found in the fourth section. The last section summarizes the main conclusions.

2. Theoretical Background – Frugal Innovation

The definition of frugal innovation is "a new management philosophy which integrates specific needs at the bottom of the pyramid markets as a starting point and works backward to develop appropriate solutions which may be significantly

different from existing solutions designed to address the needs of upmarket segments" (Gusta, 2011). In Nunes and Breene's (2011) view, it is an offer, made specifically to low-income market segments. Despite the fact that Berm and Ivens (2013) distinguish between frugal and reverse innovations in their conceptual framework, both types can be potential tools for improving businesses in the ways they use resources, add value, generate outcomes, all of them result in sustainability performance and market performance (Bencsik & Juhász, 2014).

Fukuda and Watanabe (2011) suggest that businesses have to deal with people in emerging economies as innovators or producers, not as consumers. That is to say, businesses have to pay more and a different kind of attention to their main stakeholders, and companies have to learn this new practice.

Table 1. *The principles of frugal innovation in the Radjou and Prabhu model (2015)*

Principle	Meaning
Engage and iterate	customers are involved in interactions
Flex your assets	production, logistics, services are supported by value chain
Creating sustainable solutions	consumption of new product or service
Shaping customer behaviour	brand loyalty, improve market share and make customers good with less consumption
Co-create with prosumers	co-operation and crowdsourcing provide help to collective demands and skills of customers; R&D and marketing managers have an important role
Making innovative friends	R&D would be networked, lean, flexible

Source: based on Prasad, 2015, own construction

Zeschky and his colleagues (2014) established the three-level model of resource-constrained innovation, which contains cost innovation, good-enough innovation, and frugal innovation (see *Figure 1*). To create their construction, they used the Ansoff matrix to categorize the examples examined:

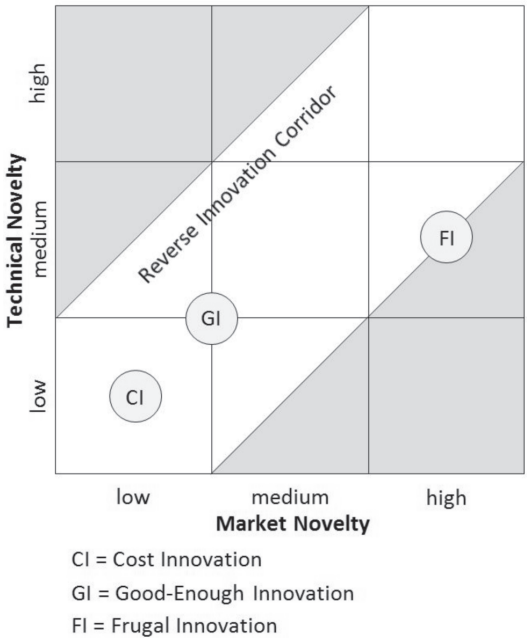
– Cost innovation ("same for less"): low scores on the market as well as technical novelty dimensions. This is based on available components, the key success factor being process capabilities such as managing production facilities in low-cost regions.

– Good-enough innovation ("tailored for less"): low–medium scores on both the market and technical novelty dimensions. This product and market innovation requires additional knowledge of technology and customers as well as an acceptable price on the market.

– Frugal innovation ("new for less"): medium–high scores on the market as well as technical novelty dimensions. Development of existing products with

new parameters or creating a completely new product for resource-constrained markets, often by the contribution of a local team.

The above innovations are built on one another and all of them lead a reverse innovation, which "refers to a market rather than a product concept" (Zeschky et al., 2014, p. 23).



Source: Zeschky et al., 2014, p. 22

Figure 1. *The resource-constrained innovation matrix*

Based on the above references, the research question is: Are Hungarian businesses ready to introduce frugal innovation? To answer this question, the following hypothesis has been created:

No matter how short Hungarian businesses are of resources, they are not ready for frugal innovation.

3. Material and Methods

The primary quantitative survey took place at the beginning of 2015 (February–March). The collection of data was in a simple, random way. The chapters of the simply structured questionnaire were:

– Innovations;
– Market Competition;

– Frugal Innovation;
– Business Strategy;
– Co-operation;
– Balanced Scorecard (BSC);
– Background Information.

This paper focuses only on the *Innovations* chapter of the questionnaire.

The questionnaire contains closed and some open-ended questions. In order to answer the attitude-related questions, the 5-grade Likert scales were used for lucidity. There were some nominal scales as well. The data were analysed with MS Excel and SPSS programmes. Several statistical methods were used. Apart from the simple descriptive statistics necessary to present the results (arithmetical average, frequency, and cross table), main component analysis was conducted.

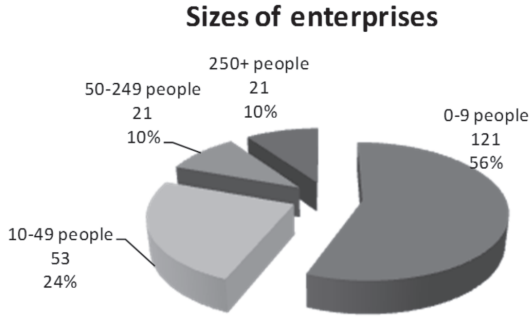
The main component analysis reduces the number of variables with a minimal loss of information. It is necessary to use it if the number of variables is too high and the aim is to reveal the structure of said variables.

During the selection, certain variables may correlate with factors which have nothing to do with them. These factors are rotated, that is their axes are turned into a simpler and more easily interpretable solution. Similarly to factor analysis, communality expresses what percentage of the variable is explained by the factor in total. Variables with a communality value of less than 0.25 may be left out of the analysis because they do not fit into the figure system. During the later stages of factor analysis, the elements appearing in the diagonal of the anti-image matrix (MSA-values) are taken into consideration because these elements show how close relationship will be between a given variable and other variables. The Bartlett-test was used to examine whether it is only a coincidence if the elements outside the main diagonal of the correlation matrix deviate from the 0 value. On the other hand, the Kaiser-Meyer-Olkin (KMO) criterion shows to what degree the variables are suitable for factor analysis, and its value is the average of the anti-image matrix MSA values. KMO<0.5 is an unacceptable value (Sajtos and Mitev, 2007).

4. Results and Discussion

4.1. Specification of the Sample

The questionnaire was filled in by 216 businesses. Based on the EC description related to the number of employees, there are multi-size enterprises in the sample:
– half of them (56%) are micro-sized enterprises (0–9 employees),
– cc. one-fourth (24%) are small-sized enterprises (10–49 employees),
– every tenth (10%) is a medium-sized enterprise (50–249 employees),
– every tenth (10%) is a large company (250+ employees).

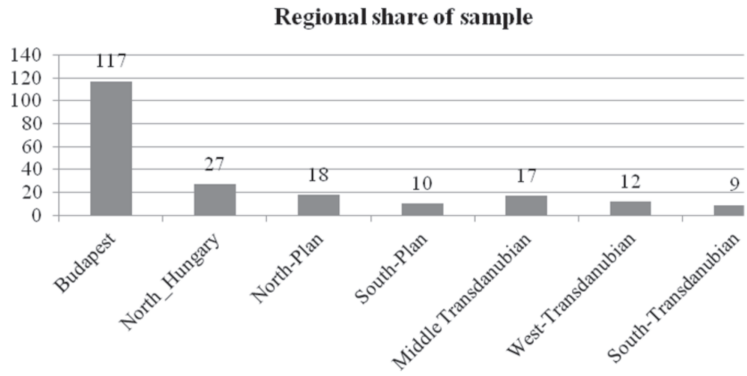


Source: own construction

Figure 2. *Categories of businesses based on their number of employees*

The surveyed businesses had been operating in several professional fields:
– (A+B) agriculture, forestry, and fishing (9 enterprises, 4.1%),
– (C) mining (1 enterprise, 0.5%),
– (D) manufacturing (23 enterprises, 10.6%),
– (E) energy (6 enterprises, 2.8%),
– (F) construction (23 enterprises, 10.6%),
– (G) wholesale, retail trade (67 enterprises, 30.9%),
– (H) HORECA (14 enterprises, 6.5%),
– (I) transport, post, storage, communication (20 enterprises, 9.2%),
– (J+K) business activity, real estate, renting (27 enterprises, 12.4%),
– (M) education (3 enterprises, 1.4%),
– (N) health care and social work (8 enterprises, 3.7%),
– anonymous (16 enterprises, 7.5%).

From a regional point of view, more than half of the businesses had been operating in the capital. In addition, the sample contains businesses from every other region as well.



Source: own construction

Figure 3. *Regional share of businesses*

The enterprises surveyed had been operating as follows:
– 0–3 years 30 businesses (14.2%),
– 4–10 years 46 businesses (21.8%),
– more than 10 years 135 businesses (64%).

4.2. Analysis of Hypothesis: No Matter How Short Hungarian Businesses Are of Resources, They Are Not Ready for Frugal Innovation

As a first step, the surveyed businesses stated the meaning of innovation. According to the number of their choices, innovation means:
– new products (48 items, 22.1%),
– new technology (52 items, 24%),
– new market (33 items, 15.2%),
– new sources of resources (12 items, 5.5%),
– new organization (8 items, 3.7%),
– all of the above mentioned (33 items, 15.2%).

The next question was the necessity of innovating and its implementation in the previous three years in the operation of business. *Table 2* clearly shows that there is no idea or need for innovating in every fifth business, and in many enterprises the necessity of innovating had emerged but was not followed through.

Table 2. *Innovation in the past of the operation*

Fields of innovation	Did not emerge	Emerged but did not follow	Emerged and implemented
Production	37 17.1%	30 13.8%	132 60.8%
Sales	49 22.6%	33 15.2%	110 50.7%

Source: own construction

According to the surveyed businesses, half of them (115 enterprises, 53%) realized some sort of technological innovation. Two-thirds of the businesses (149 enterprises, 68.7%) entered a new market.

The next step is the examination of organizational attitudes towards the question of frugal innovation, particularly creating sustainable solutions for customers and shaping their behaviour. The results clearly tell us that the surveyed businesses understand that there is no innovation without the customers' awareness or without the skill of adaptability. However, these businesses are deeply split on their ability to compete with simple, reliable, and cheap products on the market. The same uncertainty appears on the issue as to whether innovation leads to cheaper products/services for customers or not. Less than half of the businesses

agree with the statement that "it is possible to create high levels of added value from little money". And, finally, only one third (37.6%) can imagine that they would be able to develop continuously and sustainably with scarce resources. Likewise, they are uncertain of a strategy which would create more value with less work and material.

Table 3. *Positive attitudes of businesses towards the principles of frugal innovation*

Principles	Micro-sized enterprises	Small-sized enterprises	Medium-sized enterprises	Large companies	Altogether
Part of innovation is better / more **knowledge about customers.**	104 86.6%	46 86.7%	15 75.0%	18 85.7%	183 85.5%
Adaptability is a criterion of innovation.* sig=0.029; χ^2=0.170	102 85.8%	45 84.9%	15 71.4%	19 90.4%	181 84.6%
Businesses have to meet **every demand** of customers.	83 69.1%	41 77.3%	9 42.9%	18 85.7%	151 70.2%
In the competition with MNCs, it is necessary to make lean products with minimal resources and money. These products are easy to use; they are **simple and reliable** regarding their technological aspects and **cheaply manufactured**.	79 65.9%	36 69.3%	10 47.5%	15 75.0%	140 65.8%
Innovation brings down the price of products, making them affordable to customers.	78 65%	36 67.9%	11 52.4%	15 71.4%	140 65.1%
It is possible to create a high level of added value with little **money.**	**65** **54.6%**	**17** **32.0%**	**11** **52.4%**	**8** **38.1%**	**101** **47.2%**
A business is able to develop continuously and sustainably with **scarce resources**.	**49** **40.8%**	**15** **28.3%**	**10** **47.6%**	**7** **33.4%**	**81** **37.6%**
A strategy is feasible which creates more products from less work and material.	**35** **29.2%**	**16** **30.8%**	**7** **33.4%**	**10** **47.6%**	**68** **31.8%**

Source: own construction

If the above statements are reduced, they will have to be collapsed into three factors, which explain 69% of the variables. The first factor contains the statements of commitment to sustainable development and shows the power of (non-financial) resources of businesses. The second factor includes the statements made in response to tendencies in the environment. Finally, the third factor refers to the strong competition on the markets and implies eagerness to make profit.

Table 4. *The Rotated Component Matrix of attitudes toward frugal innovation**

Factors	Principles	Component		
		1	2	3
Power of sources	A business is capable of continuous and sustainable development with **scarce resources**.	.835	.002	.086
	It is possible to create a high level of added value with little **money.**	.815	.051	-.012
Environment-orientation	Part of innovation is better / more **knowledge about customers.**	-.031	.843	-.026
	Adaptability is a criterion of innovation.	.084	.835	.011
Products for everyone	Businesses have to meet customers' **every demand**.	-0.142	-.008	.828
	In the competition with MNCs, it is necessary to make lean products with minimal resources and money. These products are easy to use; they are **simple and reliable** regarding their technological aspects and **cheaply manufactured**.	.241	-.007	.770

KMO=0.510; sign. <0.000, the cumulative extraction sums of squared loadings 69.073%

Source: own construction

According to the surveyed businesses, the business model which pursues the goal of frugality and simplicity combined with good quality and low prices is:

– unfeasible (8 enterprises, 3.7%),
– probably feasible (57 enterprises, 26.4%),
– undecided about the question (83 enterprises, 38.4%),
– likely feasible (56 enterprises, 25.8%),
– absolutely certain of feasibility (12 enterprises, 5.5%).

Despite of uncertainty businesses, more than half of enterprises (55.8%) proclaim that they follow the mentioned strategy.

5. Conclusion

As far as the share of small- and medium-sized enterprises (SME-s) is concerned, the rate of micro-enterprises is higher (94.5%) than the EU average (92.4%). They employ less people, an average of 3.1 people compared to the EU average of 4.2 (SME Annual book, 2011). The added value created in the Hungarian SME sector is lower by 5% than the average with the other EU members. Enterprises operate in a difficult economic situation characterized by high taxes and social insurance charges, unpredictable economic regulation, high administrational fees and inadequate demand (KSH, 2013). The majority of the SME-s focus on the

domestic market, their activity mostly depending on the larger-sized enterprises. Medium-sized companies supply those which in turn outsource their services (Gyulai, 2013). The birth-rate of SME-s was only 8.6% in 2012, while their survival rate was 56.74% (Eurostat).

Although approximately two-thirds of the businesses interviewed had been operating for more than ten years, a high number of them stated that innovation was not an option or, where it was, it was not realized in the field of production or sales. They view mainly in terms of innovation the novelty of products (22.1%) or that of technology (24.0%). The concept of innovation as market novelty is shared only by 15.2%. If we take that 15.2% of the businesses which consider all the types mentioned to be innovation, the result is not too promising. Even if the businesses are aware of the requirements for innovation, such as knowledge of customers and adaptability, there is an obvious contradiction between the shared and followed values. Theoretically, they know very well the importance of customers' awareness and skills of adaptability for being in competition, but they practically cannot carry out innovations.

In terms of strategy, only two-thirds of the opinions (65.8%) reflect that they can compete with multinational companies realizing frugal innovations (produce simple, reliable, and lean products at low cost and price). In their judgement, to distinguish themselves from the mass products of large (multinational) companies, the SMEs have their own (higher) price and have to meet the needs and requirements of one or few segments only. Their strategy is in connection with the demands of customers as well as the processes and costs of production. These are the reasons why businesses almost cannot believe in continuous and sustainable development with scarce resources (31.8%) or in the possibility of creating high levels of added value with little money (47.2%). If they suffer from starvation of profit, they find it too difficult to adopt a strategy which would create more products and values from less work and fewer resources, what is unthinkable for the surveyed micro-, small-, and medium-sized enterprises. To summarize our examination, the formulated hypothesis is verified because the inquired Hungarian businesses are not ready for frugal innovation.

References

Balkrishna, C. R. (2014). Alleviating poverty in the twenty-first century through frugal innovations. *Challenge* 57(3), May/June: 40–59.

Bencsik, A.; Juhász, T. (2014). Innováció és tudásmenedzsment a szervezetekben. In: Juhász György; Šeben Zoltán; Dobai Korcsmáros Enikő; Huszárik Seres Erika (eds), Oktatás és tudomány a XXI. század elején: A komáromi Selye János Egyetem 2014-es Nemzetközi Tudományos Konferenciájának tanulmánykötete

[Vzdelávanie a veda na začiatku XXI. storočia: Zborník z medzinárodnej vedeckej konferencie Univerzity J. Selyeho – 2014]: Gazdaságtudományi Szekció.

Brem, A.; Ivens, B. (2013). Do frugal and reverse innovation foster sustainability? Introduction of a conceptual framework. *Journal of Technology Management for Growing Economies* 4(3), October: 31–50.

Csath, M. (2015). A fenntartható fejlődés feltételei. http://mno.hu/velemeny/a-fenntarthato-fejlodes-feltetelei-1283321. Last accessed on: 24.04.2015.

Fukuda, K.; Watanabe, Ch. (2011). A perspective on frugality in growing economies: triggering a virtuous cycle between consumption propensity and growth. *Journal of Technology Management for Growing Economies* 2(2), October: 79–98.

Gupta, V. P. (2011). Frugal innovation. The new masters of management. In: 'Jugaad' to Frugal Innovation. Indian MBA. Retrieved from: http://www.indianmba.com/Faculty_Column/FCI283/fc1283.html

www.ksh.hu

Nunes, P. F.; Breene, T. S. (2011). Jumping the S-Curve. How to beat the growth cycle, get on top, and stay there. Harvard Business Review Press, Harvard.

Prasad, S. (2015). How to do better with less. Recension of frugal innovation (Radjou, N.; Prabhu, J.), Hachette, India, *BUSINESS TODAY* April 26. 2015., p. 116.

Sajtos, L.; Mitev, A. (2007). SPSS kutatási és adatelemzési kézikönyv. Budapest: Alinea.

NTH (2013). Kkv évkönyv, 2011. Kis- és középvállalkozások stratégiája 2014–2020. Társadalmi egyeztetésre készített tervezet. (SMEs Annual Book, 2011. Strategy of SMEs 2014–2020). www.nth.gov.hu/hu/media/download/256. Downloaded on: 08.2015.

Srinivas, S.; Sutzs, J. (2008). Developing countries and innovation: searching for a new analytical approach. *Technology in Society* 30: 129–140.

Tóth, G. (2007). A Valóban Felelős Vállalat. (The real responsible company). Budapest: KÖVET. Retrieved from: http://www.otlethid.hu/doc/VFV.pdf.

Zeschky, M. B.; Winterhalter, S.; Gassmann, O. (2014). From cost to frugal and reverse innovation: mapping the field and implications for global competitiveness. *Research-Technology Management* July–August: 20–27.

Zeschky, M.; Widenmayer, B.; Gassmann, O. (2011). Frugal innovation in emerging markets: the case of mettle. *Research-Technology Management* 54(4): 38–45.

www.eurostat.com

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Bankruptcy Prediction: A Survey on Evolution, Critiques, and Solutions

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Abstract: After the economic crisis and the BASEL agreement, the bankruptcy prediction research has evolved substantially due to its importance in corporate finance. This paper summarizes the short history of bankruptcy prediction from the beginning until quite recently. First, it presents a short summary of bankruptcy prediction evolution pointing to the most used models. Then, it provides a summary of the most cited papers that discuss the evolution of bankruptcy prediction and of those papers that have contributed to bankruptcy prediction. Finally, it summarizes some critiques about bankruptcy prediction that the literature has formulated over time and provides some suggestions for future research on bankruptcy prediction.

Keywords: failure prediction, parametric modelling, non-parametric modelling, bankruptcy
JEL Classification: G33 – Bankruptcy, liquidation

1. Introduction

Bankruptcy is not a desired situation. For every person who is in contact with a company (creditor, owner, and employee), the bankruptcy process is extremely costly. For these stakeholders, the prediction and prevention is very important; they need a less expensive alternative like the reorganization of the company. Bankruptcy also has a social drawback. If a company goes bankrupt, its employees will lose their job. It is also possible that other companies that are in commercial relation will follow in bankruptcy if their activities depend on one another. In this case, the bankruptcy has a contagious effect (Doumpos & Zopoudinis, 1999). Due to this, most publications and research efforts in the field of bankruptcy prediction are based on testing and developing models that are more accurate on firm failure prediction.

Bankruptcy models are of two types: parametric and non-parametric. The most used parametric models are the multivariate discriminant analysis (MDA) and

logistic analysis (LA). The multivariate discriminant analysis classifies companies into two groups: healthy and bankrupt companies. The classification is based on the companies' financial characteristics, which are calculated with financial ratios that constitute the variables of the model. The discriminant score allows the classification of the two groups of companies. The difference between logistic analysis and MDA is that the logistic analysis requires logistic distribution (Lo, 1986). Logistic analysis takes into account the failure probability of a company. The parametric models focus on symptoms of bankruptcy and could be univariate and multivariate whose variables are mainly financial ratios (Andan & Dar, 2006).

The most popular non-parametric models are artificial neural networks (ANN), hazard models, fuzzy models, genetic algorithms (GA) and hybrid models, or models in which several of the former models are combined. The non-parametric models are mainly multivariate and depend heavily on computer technology (Andan & Dar, 2006). ANN models are able to learn and adapt, form a data set, and they have the ability to capture non-linear relationships between variables. These features are the main advantages of these models. Their weakness lies in the fact that they cannot explain causal relationships among their variables (i.e. financial ratios), which constrains their application to management problems (Lee & Choi, 2013).

The most cited survey papers in the bankruptcy literature are Balcaen and Ooghe (2004) and Bellovary et al. (2007). These papers focus mainly on parametric modelling. Balcaen and Ooghe (2004) summarize the causes that led bankruptcy prediction to evolve. Also they give an overview on six problems concerning classical statistical methods in bankruptcy prediction. These problems are related to: *assumptions on the dichotomous variable, the sampling method, stationarity assumptions and data instability, selection of independent variables, use of accounting information and the time dimension* (Balcaen & Ooghe, 2004). Bellovary et al. (2007) contributes to the bankruptcy literature by summarizing more than 160 papers between 1930 and 2004. The paper contains a table that groups the studies according to the field of application, model type with number of the used factors, and model accuracy. Another author, Kirkos (2015), focuses mainly on artificial intelligence papers[1] published between 2009 and 2011 by using systematic literature review.

This paper contributes to the literature on bankruptcy failure by presenting a summary of the most relevant survey papers in the bankruptcy literature and by complementing it with more recent papers that have contributed to bankruptcy prediction modelling. In this way, the paper provides practitioners an overview of the main problems. In addition, it provides a summarized description of bankruptcy research regarding modelling and applications by pointing to the main publications in this field.

1 This author studied 119 papers, out of which he studied 42 in depth. All studied papers are related to the usage of artificial intelligence.

The remainder of this paper is organized as follows. Section 2 briefly summarizes the evolution of bankruptcy prediction. Section 3 provides a summary of the most cited papers that discuss the evolution of bankruptcy prediction and of those papers that have contributed to bankruptcy prediction. Section 4 summarizes some critiques about bankruptcy prediction that the literature has formulated over time and provides some suggestions for future research on bankruptcy prediction. Section 5 concludes.

2. Evolution of Bankruptcy Prediction

Balcaen and Ooghe (2004) studied the 35 years of bankruptcy prediction. They found six causes that have made bankruptcy prediction develop in time:

1. The stakeholders of a company are put to high costs if the company goes bankrupt. The need of a less costly method was wanted.
2. Because of negative economic trends or stocks, many companies become increasingly vulnerable to failure and become bankrupt.
3. The financial information of companies becomes public what has helped bankruptcy prediction a lot.
4. The appearance of new papers based on imperfect markets and information asymmetry.
5. The need of getting better reports on financial health. The independent auditor can make a good summary of a company's health, but it cannot predict bankruptcy; that can be made only by modelling.
6. The BASEL agreements resulted in that further analysis were conducted aiming for new models; in this case, the capital can be divided optimally.

Fitzpatrick was the first who studied bankrupt and non-bankrupt firms' financial ratios. In his paper, he compared 20 companies' financial ratios, and found that there are significant differences between bankrupt and healthy firms, mainly between liquidity, debt, and turnover ratios (Fitzpatrick, 1932). Smith and Winakor (1935) were the first who studied the financial ratios in pairs. Their research is based on 183 bankrupt companies. Beaver (1966) found out that 30 financial ratios are relevant in distinguishing bankrupt companies from non-bankrupt ones, but, in the end, with the use of cash flow and total asset ratio the accuracy of the model was 90% before one year of bankruptcy. His result was based on univariate discriminant analysis, while the sample he used was based on 79 pairs of companies. We mention Chudson (1945), who found out that industry-specific models are more appropriate than general applications across industries.

The first multivariate statistical model is linked to Altman from 1968. Altman had the idea that univariate modelling is not enough for predicting bankruptcy. Using multivariable modelling, he created the model known as the Altman model.

Since that, his model has been well-known and used as benchmark (Bellovary et al., 2007). Altman used 33 pairs of firms (bankrupt and non-bankrupt), studying their financial ratios for 18 years with multivariate discriminant analysis (MDA) (Altman, 1968). The Altman model is based on five financial ratios and has an accuracy of 95%. Altman developed his model, known as ZETA model, which is used even today in predicting financial failure (Altman et al., 1977). The new model contained six financial ratios (from these ratios, one was the size of the firm). The model was based on examining 58 pairs of companies for 16 years, and its accuracy was 96%.

Since Altman, many researchers have used the discriminant analysis, making changes, integrating or substituting new ratios which were significant on different samples and business cultures. Some researchers used corrections with industry averages, and as a result they concluded that these models have better accuracy in predicting bankruptcy. Such well-known models were developed by Deakin in 1972, Blum in 1974, Springate in 1978, and Fulmer in 1984. Deakin used 14 financial ratios, from which four were cash-flow-based ratios. Blums' model used accounting ratios and their change in time.

Since the 1980s, a new model has been developed: the logistic regression analysis. The model was developed by Ohlson. He used the financial data starting from 1970 to 1976. The database contained 105 bankrupt and 2,058 non-bankrupt companies. The uniqueness of this model is that it does not take into consideration what the MDA proposes: the normal distribution of the variables does not let the dummy variables be used; secondly, the variance and covariance matrix must be the same in the case of bankrupt and non-bankrupt firms. Finally, one of the weaknesses of the MDA is that it does not predict the probability of failure (Ohlson, 1980). Ohlson was the first who managed to show a negative relation in the size of companies. We must mention Zmijewski, who published his research results in 1984 using probit modelling (Zmijewski, 1984). Zmijewski used 40 bankrupt and 800 healthy firms in the period of 1970–1978. His sample was made of unequal data, increasing the rate between a bankrupt and a non-bankrupt firm from 1:1 to 1:20. Unfortunately, these models did not evolve because their hard and complex usage (Bellovary et al., 2007). With the appearance of these two types of models (logit and probit modelling), the number of papers raised, mostly because many papers made comparison between MDA and logit analysis. The aim of the papers was to study which model had better accuracy based on different variables and data samples. The logistic regression analysis is more often used because it does not need the normal distribution of the variables and the covariance matrix does not need to be equal. One of the biggest disadvantages of the logistic analysis is the problem of multi-colinearity between the variables. This problem can be resolved with using principal component analysis. The next table summarizes the important milestones in bankruptcy prediction, showing which model is from parametric family or non-parametric family.

Table 1. *Important milestones in bankruptcy prediction*

Use of ratio analysis to predict bankruptcy	1932 – Fitzpatrick, 13 ratios, 19 successful and 19 bankrupt firm 1935 – Smith and Winakor, analysis of 183 failed companies 1945 – Chudson, who studied the patterns of financial structure 1962 – Jackendoff, who compared the ratios of profitable and unprofitable firms 1966 – Beaver, first to use univariate analysis		
Multivariate analysis (MDA, LA, PA)	1968 – Altman Z score, first multivariate analysis 1978 – Altman and Eisenbeis, incorporating the time dimension 1980 – Ohlson, first logistic analysis 1984 – Zmijewski, probit analysis 1985 – Gentry et al. introducing the cash flow indicators		
Introducing the AI, mixed, hybrid models	1988 – Messier and Hansen, neural network analysis 1989 – Aziz and Lawson, importance of cash-flow-based models 1992 – Dweyer, comparison of parametric and non-parametric modelling 1993 – Laitinen, re-estimation of the models 3 years prior to failure 2001 – Shumway, hazard modelling 2004 – Lam, fundamental and technical analysis integration in ANN 2004 – Jones and Hensher, mixed logit model 2005 – Beaver et al., hazard modelling and effects of time on bankruptcy prediction 2007 – Agarwal and Taffler, performance of market-based and accounting-based models 2009 – Li and Ho, hybrid method combining Fuzzy kNN with GA 2011 – De Andrés et al., hybrid method combining fuzzy clustering and MARS 2013 – Hernandez and Wilson, combining accounting, market-based and macro-economic data 2014 – Trabelsi et al., Bayesian, Hazard, and Mixed logit modelling	Parametric modelling (MDA, LA, PA, etc.)	Non - parametric modelling (ANN, BM, HM, FM, GA)

Source: own editing based on Balcaen & Ooghe, 2004, Bellovary et al., 2007, Kirkos, 2015. Abbreviation used: MDA – multi-discriminant analysis, LA – logistic analysis, PA – probit analysis, HM – hybrid model, FM – fuzzy method, GA – genetic algorithm, ANN – artificial neural network, BM – Bayesian method, AI – artificial intelligence.

Since the 1990s, the informatics technology has evolved a lot, helping artificial intelligence and managerial systems. A new family of bankruptcy modelling was born: the analysis of neural network (the ANN is a non-parametric modelling). The use of neural networks in bankruptcy prediction is linked to Messier and

Hansen (1988), who were followed by many others (in Bellovary et al., 2007) such as: Raghupathi et al. (1991), Coats and Fant (1993), Guan (1993), Tsukuda and Baba (1994), and Altman–Marco–Varetto (1994). The analysis of neural network performs a classification; the neurons are nodes with weighted interconnections organized in layers. In the input layer, each node receives information about the company's financial situation and converts into single output. This output is accepted as a classifying decision or re-transmitted till decision is accepted. The acceptance is based on pre-established criteria (Virág & Kristóf, 2005). The ANN contains many other methods: backpropagation (Dwyer, 1992), SOF-self organizing map (Alam et al., 2000).

Beside the neural network analysis, many other models arise from the non-parametric group like hybrid modelling. These models are the use of two other models either parametric or/and non-parametric (for example MDA and ANN) (Lee et al., 1996). Genetic algorithm works as a stochastic search technique to find out if a company goes bankrupt or not (Varetto, 1998). Other non-parametric models are: genetic programming (Etemadi et al., 1990), modelling based on "rough test" theory (Dimitrias et al., 1999), Bayesian, Hazard, Fuzzy, and Data Envelopment Analysis (DEA).

Many publications were born with the aim of comparing these models or of making a new one, always aiming at maximum accuracy. After 2005, the artificial-intelligence-based models are more frequent beside the hybrid models. The paper published by Premachandra et al. (2009) compares LR and DEA. The authors concluded that the DEA models have a better accuracy predicting bankruptcy (accuracy between 84% and 89%), but the LR is more accurate in predicting healthy firms (accuracy between 69.3% and 99.47%). The DEA model was better in estimating bankruptcy based on out-of-sample data (74%–86% in the case of DEA) (Premachandra et al., 2009).

Verikas et al. (2010) make a review of hybrid modelling and ensemble-based soft computing techniques applied in bankruptcy prediction. The paper presents the most relevant publications in this area (Verikas et al., 2010 – see *Table 2* on p. 1006).

An interesting approach is made in the paper published by Korol and Korodi (2011), who use fuzzy logic modelling. The model is built up on the financial data of 132 companies (107 non-bankrupt and 25 bankrupt). They compared two models. The first model is constructed with static financial ratios and the second model is based on the statics and dynamics of financial ratios. The accuracy is better in the second model with 1.85 percentage points – 88.9%. The models containing the dynamics of financial variables have a better accuracy (81.48%) even in the case of predicting bankruptcy 3 years in advance (Korol & Korodi, 2011).

The hazard modelling is another used method of predicting bankruptcy. Gupta et al. (2014) studied the use of a discrete-time hazard model on the data base of 385,733 non-bankrupt and 8,162 bankrupt SMEs. The uniqueness of the paper is

that it develops three hazard models for micro-, small-, and medium-sized firms. The accuracy is between 74.14% and 76.10%. Also, the authors concluded that the financial reports do not provide sufficient information about the default of the micro-firms (Gupta et al., 2014).

Nowadays, 3 major groups of modelling are used in bankruptcy prediction: Bayesian, Hazard, and Mixed Logit (Trabelsi et al., 2014). The accuracy and effectiveness was tested by Trabelsi et al. (2014) in their paper, and they concluded as result that the Bayesian model has the smallest misclassification if the optimal cut of point was predicted on the learning sample.

Besides the artificial intelligence, there are still further studies that try alternative models in bankruptcy prediction. Ming Xu and Chu Zhang (2009) compare statistical-based models with market-based models like the option pricing model. The data used are from 3,510 companies' financial data from the Tokyo exchange market. The authors concluded that in the case of Japanese companies the option price modelling has a better prediction capability. Secondly, the statistical model together with the option price model has a greater accuracy. The authors mention the fact that the Japanese culture diverges form other business cultures because of the Keiretsu structure (Xu & Zhang, 2009).

3. Literature Review of Bankruptcy Prediction

This section tries to summarize the main literature review in bankruptcy prediction and the formulated critiques and problems conceived in earlier papers that should be resolved, improving the model prediction accuracy.

Bankruptcy prediction models have become increasingly complex with the development of computing techniques. However, there is no generally accepted bankruptcy prediction model (Constand & Yazdipour, 2011). This is because there is no general definition of bankruptcy. The papers that aim to develop a model with statistical analysis have a different point of view on the bankruptcy term (Bellovary et al., 2007). These papers can be divided into two categories:

(i) Bankruptcy is seen as a legal procedure and the companies have already taken a legal action.

(ii) Bankruptcy is viewed as a financial distress in the sense that companies cannot meet their payment obligations. In these situations, the companies are not seen as bankrupt because they still have the chance of being reorganized and to continue their activities.

Based on these two categories, we can see that the first group includes companies that are under a legal action whose final step is their liquidation. The second point of view is more likely a short-term financial distress, which can be resolved by grouping the payment obligations under legal supervision. These two points of

views differ from each other. There should be made some investigation based on two data samples: the first sample based on eventually liquidated companies and the second sample based on companies with financial problems (financially distressed). These two groups can be compared in time before going into bankruptcy to see the differences. This is hard to resolve because financially distressed companies tend to be similar to the healthy ones regarding long-term debt ratios.

The paper of Balcaen et al. had the aim to show the strengths and weaknesses of univariate, risk-index-based models, multivariate discriminant models, and conditional probability models. Further, they show the lack of the logistic regression analysis including logistic regression, probit, and linear probit models. As a conclusion, the authors mentioned several problems and solutions related to the classical statistical methods of MDA and conditional probability models:

– the use of dichotomous dependent variables which are contrary to the business reality;

– there are problems on sampling methods, non-stationarity, and data instability, which result in poor predictive abilities over time;

– the use of macroeconomic and industry-specific variables help the predictive accuracy of the models;

– the selection of the variables is made arbitrarily – the variables may be selected within the theoretical framework;

– the time dimension problem, the classical statistical models ignore the changes over time (Balcaen & Ooghe, 2004).

Bellovarys' paper (2007) presents in details the most important papers in bankruptcy prediction. The authors present 165 papers starting from 1966 to 2004. From these papers, 43 studies compare two or more models. They did not account for those papers that replicate a model. In the appendix, it is presented the field used in different prediction models. From this point of view, the models can be organized into three major groups: general (the models are based on samples from different industries), banks, and industry-specific models. The models can be divided into two major groups: parametric and non-parametric groups. In the parametric group, the most frequently used are the multi-discriminant analysis and the logistic regression. The main models used in the non-parametric group are the artificial neural network, the Bayesian models, the Hazard models, the Fuzzy models, the Genetic Algorithm, and the Hybrid models. Most of the models were applied for general use, but with time bankruptcy prediction became more industry-specific due to the many publications that had showed that accuracy could be increased if industry-specific data sets were used (Bottazzi et al., 2010; Virág et al., 2013). Many research papers (such as those of: Martin, 1977; Santomero & Vinso, 1977; Rose & Kolari, 1985; Pantalone & Platt, 1987; Martin-del-Brio & Serrano-Cinca, 1995; Alam et al., 2000) used data from banking financial statements for predicting bank failure.

Till the 1990s, the MDA was the most frequently used modelling, but after that the neural network modelling came as first because of the higher accuracy rate what even today is still disagreed upon (Bellovary et al., 2007). The numbers used in the models differ from one another. The most used variable in a model is 57, but its prediction accuracy is not better than that of the less frequently used variables (Bellovary et al., 2007). The high number of variables used does not mean that a model is better (Jones, 1987). The average number of used variables is 8. The most frequently used financial ratio in models is the return on assets, general liquidity, and working capital on total assets. The cash-flow-based ratios became attractive later, but these ratios became intensively used (this is normal if we take in consideration that bankruptcy is the result of the payment failure of a company, which means that they do not have cash to pay). One of the most used cash flow variable is the cash flow based on assets (Bellovary et al., 2007).

The accuracy of the models has increased in time, but the difference between the minimal and maximal accuracy has become wider. The most accurate models are the neural networks, but the results of these models are complicate to interpret (there exist models with 100% accuracy). These models are followed by MDA and logistic regression.

With the evolution of artificial intelligence, the use of non-parametric models has become more and more frequent. Other models in these groups are: neural networks, genetic algorithms, decision trees, support vector machines, k-nearest neighbour, fuzzy expert system, and hybrid models.

A review of literature in artificial intelligence models used in bankruptcy prediction can be found in Perez (2006), Ravi (2007), Verikas et al. (2010), and Kirkos (2015). Perez's paper reviews 30 papers and the use of NN models and its weaknesses (Perez, 2006). Ravi (2007) makes a summary comprising a longer period of time (1968–2005) in this field. Verikas et al. (2010) made further corrections of calculation, which helped the creation of new hybrid models.

Kirkos (2015) is different from the others: firstly, because he is the first to use the Systematic Literature Review technique; secondly, because the 42 papers published between 2009 and 2011 are taken from highly reputed papers (Thomson-Reuter database, with impact factors higher than 0.5); thirdly, because he uses a holistic approach in his paper concentrated around six major axes: first, the *aim of bankruptcy prediction research* in the field of artificial intelligence, secondly, *methods used in classification*, thirdly, the used models and the used factor with their *effects*, fourthly, the *type of used data* and the *characteristics of used data*, fifthly, which data set was *finally selected*, and lastly what *the conclusions and findings* were. The accuracy of the studied models was between 72% and 100%. Half of the studies had an accuracy of 81–90%, while 29% of the papers exceeded the accuracy of 91%. One of the final conclusions was – as in Altman et al. (1995) and Dimitras et al. (1999) – that bankruptcy prediction

accuracy decreased if the data originated from more than 2 or 3 years before the bankruptcy; this is due to the presumption that bankruptcy is a process, not an event. These results are opposite to the presumptions proposed by other researchers that the financial ratios must be taken as time series.

From Kirkos's study, we can conclude that the most frequently used models for accuracy benchmark for the neural networks are logistic regression and discriminant analysis. Many of these studies concluded that the neural network has a better predictability if a smaller sample is used; in the case of big data samples, the learning process can be a problem (over learning) (Chen, 2011; Lee et al., 2005). To this fact, Du Jardin and Severin (2011) gave an explanation that there are companies that are survivors because of the diversification of their activity, and if they are included in big data samples they will occur more frequently, so the classification error is bigger in the learning process.

4. Critiques Formulated and Suggestions for Future

The critiques formulated in bankruptcy prediction are formulated to the use of financial ratios, sampling methods, the lack of non-financial variables, and the use of the period. The time series used is an important factor in predicting failure. The researches did not prove that the use of time series variables is better than the one-year variables before bankruptcy. The time period should be carefully chosen because if there are economic changes, besides the financial ratios, the model should contain important macroeconomic variables too.

The most frequent variable used in bankruptcy prediction is the use of financial ratios. This is due to the publicity of the financial data and because there is a high motivation to get more accurate models. The importance of accuracy comes from cost efficiency and capital optimization. The type I and type II errors have significant disadvantages for investors. Finally, the financial ratio database is simple to use in statistical modelling and has high accuracy as seen in many publications, close to and even reaching 100% (Bellovary et al., 2007; Balcaen & Ooghe, 2004; Kirkos, 2015). There are many critiques formulated to the use of financial variables in bankruptcy prediction. One of them is the use of dichotomous variables. In real business life, the corporate failure is not a clearly separated situation. Another issue, due to the usage of financial ratio, is the distribution of irregularities in the case of financial ratios (Martikainen et al., 1995). Martikainen et al. (1995) give transformation suggestions for ratio classification. In their paper, the authors found that the distribution irregularities have a significant effect on financial ratio classification. Altman and Sabato (2007) used logarithmic transformation for financial variables, increasing this way the information value of each variable.

For the same problem, Blanco et al. (2012) used hyperbolic tangent transformation for five financial variables.

Critiques are formulated to the use of only financial variables. The critiques are driven from the opinion that bankruptcy is the effect of many variables, not only financial ones. Bankruptcy is the effect of misleading (human factor) and economic situation. In this way, the use of only financial variables is not enough.

Many papers try to use financial variables with non-financial variables. Constand and Yazdipour (2011) argue that most of the researches leave out the human factor from the variables. Their solution is to use the cognitive psychology and neuron science, which have already changed our perception and our knowledge on financial decision behaviour. There are results that show that managers tend to take higher risk in investing in a high-risk project if they find that project interesting (Constand & Yazdipour, 2011). In their paper, the authors make a short review of those papers that studied the entrepreneurial behaviour, pointing out that the human factor is relevant in starting a company and it is a factor that influences bankruptcy (Kahneman & Lovallo, 1993).

The paper by Altman et al. (2010) studied the importance of non-financial variables (default events on a monthly basis are available from government agencies) in SME business failure besides the financial ratios (data sample: almost 6 million SMEs). Their conclusion was that the non-financial variables improved prediction accuracy by up to 13%. The same results were concluded in the paper of Gupta et al. (2014). Their research used hazard function with financial variables and non-financial variables. The non-financial variables used were the firms' audit information, compliance information, the firms' age, their accounts filing history, and the legal actions taken by lenders. The authors used a heterogeneous panel of 8,162 failed and 385,733 non-failed UK SMEs between 2000 and 2009. The results showed that micro-companies should be treated separately in bankruptcy prediction. The use of only financial ratios does not provide enough information on the default (Gupta et al., 2014).

Another group of studies developed bankruptcy prediction models which use besides financial ratios market-based ratios and macroeconomic variables, combining these into a model (Hernandez and Wilson, 2013). The authors used from 130 variables 3 financial ratios and 2 macroeconomic variables, and they compared the results in a panel logit model. The results were that the use of macroeconomic variables gives the model a better accuracy than the models that use only financial or financial and market variables (Hernandez & Wilson, 2013). In their paper, Xu and Zhang (2009) compared accounting variables, option pricing theory-based variables and other economic-variables-based models. They found out that with the model that combines accounting variables with option pricing variables predictability is higher than with the model only based on accounting variables (Xu and Zhang, 2009).

There are a few papers that study the importance of legal acts on bankruptcy. These papers find that decision makers and laws can generate modification in bankruptcy prediction – see the papers of Dewaelheyns & van Hulle (2008), Laitinen (2011), and García & Sanguinetti (2014).

5. Conclusions

The present paper summarizes the short evolution of bankruptcy prediction and the main critiques made on modelling and prediction of bankruptcy, as well as it summarizes the future research avenues recommended in these studies. The critiques are based on three important survey papers, namely Balcaen and Ooghe (2004), Bellovary et al. (2007), and Kirkos (2015), where the latter is a review of the most important papers in artificial intelligence and theoretical approaches.

A final conclusion can be made that, based on the reviewed papers, bankruptcy prediction still has new, unconquered fields because of the diversity of business culture (see Xu & Zhang, 2009), on the one hand, and due to its complexity, on the other hand, there is an area that has not been properly explored. The knowledge on managerial behaviour can be used in bankruptcy predictability.

Another possible avenue for future research is to statistically classify the different models by their inputs (number of ratios used, type of ratios used, cultural characteristics, models used, industry type, macroeconomic factors, and other relevant independent variables taken from the models) and use the accuracy of that model as a dependent variable. We believe that this way it is possible to obtain further information on why some models are better than others.

References

Adnan, M.; Dar, A. H. (2006). Predicting corporate bankruptcy: where we stand? *Corporate Governance* 6(1): 18–33.

Agarwal, V.; Taffler, R. (2008). Comparing the performance of market-based and accounting-based bankruptcy prediction models. *Journal of Banking and Finance* 32: 1541–1555.

Alam, P.; Booth, D.; Lee, K.; Thordarson, T. (2000). The use of fuzzy clustering algorithm and self-organizing neural networks for identifying potentially failing banks: an experimental study. *Expert Systems with Applications* 18: 185–199.

Altman, E. I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *The Journal of Finance* 23(4): 589–609.

Altman, E. I.; Sabato, G. (2007). Modelling credit risk for SMEs. Evidence from US Market. *A Journal of Accounting, Finance and Business Studies*. 43(3): 332–357.

Altman, E. I.; Haldeman, R.; Narayanan, P. (1977). ZETA analysis, a new model for bankruptcy classification. *Journal of Banking and Finance* 1(1): 29–54.

Altman, E. I.; Wilson, N.; Sabato, G. (2007). The value of non-financial information in SME risk management. *The Journal of Credit Risk,* 6(2): 1–40.

Balcaen, S.; Ooghe, H. (2004). 35 years of studies on business failure: an overview of the classical statistical methodologies and their related problems. *Working paper. Ghent University*, June, 248: 1–62.

Beaver, W. H.; McNichols, M. F.; Rhie, Jung-Wu (2005). Have financial statements become less informative? Evidence from the ability of financial ratios to predict bankruptcy, *Review of Accounting Studies* 10: 95–122.

Bellovary, J.; Giacomino, D.; Akers, M. (2007). A review of bankruptcy prediction studies: 1930–present. *Journal of Finance Education* 33: 1–42.

Blanco, A.; Irimia, A.; Dolores, M. O. (2012). The prediction of bankruptcy of small firms in the UK using logistic regression. *Análisis Financiero* 118: 32–40.

Bottazzi, G.; Grazzi, M.; Secchi, A.; Tamagni, F. (2010). Financial and economic determinants of firm default. *FINNIV Discussion Paper*. pp. 1–29.

Camerer, C.; Lovallo, D. (1999). Overconfidence and excess entry: An experimental approach. *The American Economic Review* 89(1): 306–318.

Chen, M. Y. (2011). Bankruptcy prediction in firms with statistical and intelligent techniques and comparison of evolutionary computation approaches. *Comput. Math. Appl.* 62: 4514–4524.

Constand, L. R.; Yazdipour, R. (2011). Firm failure prediction models: a critique and a review of recent developments, advances in entrepreneurial finance: with applications from behavioral finance and economics. *Springer Science and Business Media*. pp. 185–204.

Chudson, W. (1945). The pattern of corporate financial structure. New York: *National Bureau of Economic Research*.

Dewaelheyns, N.; van Hulle, C. (2008). Legal reform and aggregate small and micro business bankruptcy rates: evidence from the 1997 Belgian bankruptcy code. *Small Business Economics* 3: 409–424.

Dimitras, A.; Zanakis, S.; Zopounidis, C. (1996). A survey of business failures with an emphasis on prediction methods and industrial applications. *European Journal of Operational Research* 90: 487–513.

Dimitras, A. I.; Slowinski, R. S.; Zoupounidis, C. (1999). Business failure prediction using rough sets. *European Journal of Operation Research* 114(2): 263–280.

Doumpos M.; Zopoudinis C. (1999). A multicriteria discrimination method for the prediction of financial distress: the case of Greece. *Multinational Finance Journal* 3(2): 71–101.

Dwyer, M. (1992). A comparison of statistical techniques and artificial neural network models in corporate bankruptcy prediction. *Ph.D. dissertation*. University of Wisconsin-Madison.

Fitzpatrick, P. (1932). A comparison of the ratios of successful industrial enterprises with those of failed companies. Washington: The Accountants' Publishing Company.

Fulmer, J.; Moon, J.; Gavin, T.; Erwin, M. (1984). A bankruptcy classification model for small firms. *Journal of Commercial Bank Lending* July: 25–37.

García-Posada, M.; Mora-Sanguinetti, J. S. (2014). Are there alternatives to bankruptcy? A study of small business distress in Spain. *SERIEs* 5: 287–332.

Gupta, J.; Gregoriou, A.; Healy, J. (2014). Forecasting bankruptcy for SMEs using hazard function: To what extent does size matter? *Review of Quantitative Finance and Accountings, Springer Science+Business Media*. pp. 1–25.

Hernandez, M. T.; Wilson, N. (2013). Financial distress and bankruptcy prediction among listed companies using accounting, market and macroeconomics variables. *International Review of Financial Analysis* 30: 394–419.

De Andrés, J.; Lorca, P.; Javier de Cos Juez, F.; Sánchez-Lasheras, F. (2011). Bankruptcy forecasting: A hybrid approach using Fuzzy c-means clustering and Multivariate Adaptive Regression Splines (MARS). *Expert System with Applications* 38: 1866–1875.

Jones, F. (1987). Current techniques in bankruptcy prediction. *Journal of Accounting Literature* 6: 131–164.

Kahneman, D.; Lovallo, D. (1993). Timid choices and bold forecasts. A cognitive perspective on risk taking. *Management Science* 39(1): 17–31.

Kirkos, E. (2015). Assessing methodologies for intelligent bankruptcy prediction. *Artificial Intelligence Review* 43: 83–123.

Koro, T.; Korodi, A. (2011). An evaluation of effectiveness of Fuzzy logic model in predicting the business bankruptcy. *Romanian Journal of Economic Forecasting* 3: 92–107.

Laitinen, E. K. (2011). Assessing viability of Finnish reorganization and bankruptcy firms. *European Journal of Law and Economics* 31: 167–198.

Lee, K. C.; I. Han; Y. Kwon (1996). Hybrid neural network models for bankruptcy predictions. *Decision Support Systems* 18(1): 63–72.

Lee, K.; Booth, D.; Alam, P. (2005). A comparison of supervised and unsupervised neural networks in predicting bankruptcy of Korean firms. *Expert System Application* 29: 1–16.

Lee, S.; Choi, W. S. (2013). A multi-industry bankruptcy prediction model using back-propagation neural network and multivariate discriminant analysis. *IExpert System with Applications* 40: 2941–2946.

Lo, A. W. (1986). Logit versus discriminant analysis. A specification test and application to corporate bankruptcies. *Journal of Econometrics* 31: 151–178.

Martikainen, T.; Perttunen, J.; Yli-Ollie, P.; Gunasekaran, A. (1995). Financial ratio distribution irregularities: implication for ratio classification. *European Journal of Operational Research* 80: 34–44.

Martin, D. (1977). Early warning of bank failures: A logit regression approach. *Journal of Banking and Finance* 1: 249–276.

Martin-del-Brio, B.; Serrano-Cinca, C. (1995). Self-organizing neural networks: The financial state of Spanish companies. *Neural Network in the Capital Markets*. In: Refenes (ed.), Chichester: Wiley, pp. 341–357.

Messier, Jr., W.; Hansen, J. (1988). Inducing rules for expert system development: an example using default and bankruptcy data. *Management Science* 34(12): 1403–1415.

Ohlson, J. A. (1980). Financial ratios and the probabilistic prediction of bankruptcy. *Journal of Accounting Research* 18(1): 109–131.

Pantalone, C.; Platt, M. (1987). Predicting commercial bank failure since deregulation. *New England Economic Review*, Federal Reserve Bank of Boston July–August, pp. 37–47.

Perez, M. (2006). Artificial neural network and bankruptcy forecasting: a state of the art. *Neural Comput. Appl.* 15: 154–163.

Premachandra, I. M.; Bhbra, G. S.; Sueyoshi, T. (2009). DEA as a tool for bankruptcy assessment: A comparative study with logistic regression technique. *European Journal of Operational Research* 193: 412–424.

Ravi, K. P.; Ravi, V. (2007). Bankruptcy prediction in firms and banks via statistical and intelligent techniques – a review. *European Journal of Operation Research* 180: 1–28.

Rose, P.; Kolari, J. (1985). Early bankruptcy prediction using neural networks: A new tool for predicting bank failures. *Decision Sciences* 23: 899–916.

Sands, E.; Springate, G.; Var, T. (1983). Predicting business failures: a Canadian approach. *CGA Magazine* 17: 24–27.

Santomero, A.; Vinso, J. (1977). Estimating the probability of failure for commercial banks and the banking system. *Journal of Banking and Finance* 1(2): 185–205.

Smith, R.; Winakor, A. (1935). Changes in financial structure of unsuccessful industrial corporations. *Bureau of Business Research*, Bulletin no. 51. Urbana: University of Illinois Press.

Trabelsi, S.; He, R.; He, L.; Kusy, M. (2014). A comparison of Bayesian, Hazard and mixed logit model of bankruptcy prediction. *Computing Management Science* January: 1–17.

Vareto, F. (1998). Genetic algorithms applications in the analysis of insolvency risk. *Journal of Banking and Finance* 22: 1421–1439.

Verikas, A.; Kalsyte, Z.; Bacauskiene, M.; Gelzinis, A. (2010). Hybrid and ensemble-based soft computing techniques in bankruptcy prediction: a survey. *Soft Computing* 14: 995–1010.

Virág, M.; Kristóf, T.; Fiáth, A.; Varsányi J. (2013). Pénzügyi elemzés, csődelőrejelzés, válságkezelés. Budapest: Kossuth Kiadó.

Virág, M.; Kristóf, T. (2005). Az első hazai csődmodell újraszámítása neurális hálók segítségével. *Közgazdasági Szemle* LII(February): 144–162.

Xu, M.; Zhang, C. (2009). Bankruptcy prediction: the case of Japanese listed companies. *Review of Accounting Studies* 14: 534–558.

Zmijewski, M. E. (1984). Methodological issues related to the estimation of financial distress prediction models. *Journal of Accounting Research* 24(Supplement): 59–82.

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