ACTA UNIVERSITATIS AGRICULTURAE ET SILVICULTURAE MENDELIANAE BRUNENSIS

Volume 64 190 Number 5, 2016
http://dx.doi.org/10.11118/actaun201664051717

A COMPARISON OF THE MARKET ORIENTATION MODEL IN CZECH AND GERMAN HIGH-TECH COMPANIES

Patrik Jangl[1]

[1] Department of Management and Marketing, Faculty of Management and Economics, Tomas Bata University in Zlin, Mostní 5139, 760 01 Zlín, Czech Republic

Abstract

JANGL PATRIK. 2016. A Comparison of the Market Orientation Model in Czech and German High-Tech Companies. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis,* 64(5): 1717–1729.

A Market orientation belongs to the permanent factors of success and even in the periods of economic instability it helps to keep a company in a good condition. This article aims to compare the Czech and German model of market-orientation of high-tech companies in the manufacturing industry. the overall index of market orientation in the Czech Republic and Germany is almost identical. Subsequently, invariance was tested using the method of Multigroup Confirmatory Factor Analysis. a comparison of absolute terms of the models shows that significant difference among the coefficients exists in the item regarding obtaining information about competitors – i.e. competitor intelligence generation. the research did not demonstrate statistically significant differences between the models. All criteria consistently confirm configural, metric and partial scalar invariance. the only rejected equivalence is scalar invariance. In this study, therefore, no significant differences were demonstrated between the models of market-orientation of Czech and German high-tech companies. There are other studies that deal with the measurement invariance models of market-oriented high-tech companies. Using Czech and German data, this work has helped to clarify that the two versions of the measuring instruments (English and Czech) are indeed equivalent to each other. Based on the research findings, academics and managers are recommend the use both measuring scales indiscriminately as valid tools for determining the index of market orientation in high-tech firms in the manufacturing industry. For now, there is no similar or comparable research in the Czech Republic or Germany. For this reason, it seems appropriate to replicate this research in the future, including discussions with authors who deal with the issue of market orientation.

Keywords: modified market orientation model (MMOM), modified market orientation scale (MMOS), index of market orientation, high-tech sector, invariance analysis, Germany, Czech Republic

INTRODUCTION

Market orientation of companies has been one the most popular topics of marketer worldwide especially in the past twenty-five years. Yet it appears that most managers have no sufficient knowledge of this model. In earlier research, the emphasis was on finding a suitable model of market orientation in various countries and industry sectors. Numerous studies on the effect of market orientation on innovation and corporate performance also occur. It is mainly innovations that propel high-tech companies in the manufacturing industry to perform. Also the subsequent commercialization of products, in which correct implementation of market orientation plays a significant role, is equally important. the main objective of this paper was to compare the Czech and English shortened versions of market orientation measuring scales MMOS (Modified Market Orientation Scale), which are conceptually and graphically described in the Modified Market Orientation Model (MMOM). a similar study (invariance testing) that would provide an international comparison of the model of market-orientation of high-tech companies

(MMOM) is non-existent in the Czech environment. the modified model summarizes the current knowledge of market orientation of the last three decades with an emphasis on market information dissemination, as well as its integration across all departments in the company. the shortened and modified version of the measuring scale was created in the Czech cultural conditions and it seems to be most useful for a corporate practice. Replication of this study was carried out in the German high-tech companies with similar results e.g. Jangl (2015c, 2015d). In the first part of the article, the readers become acquainted with the selected model of market orientation and the high-tech sector as such. the first part is followed by an analysis of psychometric properties of both models, determining the index of market orientation and invariance testing.

Market Orientation in Theory

Businesses that value and rely on market information to guide their strategic decision-making are commonly described as market oriented (Mohr *et al.*, 2010). the author of this paper understands market orientation as a process of customer intelligence generation, competitor intelligence generation, intelligence dissemination & integration, and responsiveness to market intelligence. the hypothesis of a four-factor structure of the market-orientation model of high-tech companies (see Fig. 1) has been confirmed in the previous studies, for example by Jangl (2015a, 2015b). the essential idea is based on the company's ability to obtain relevant market information, to spread such information across various company departments and be able to respond to it. Harrison-Walker (2001) used a similar model of market orientation, which contains the two following factors: customer orientation and competitor orientation. Each of them comprises of a four-stage process – acquisition of information, organization-wide sharing of information, a shared interpretation of market information, and utilization of market information.

Kohli and Jaworski (1990) define market orientation as implementation of a marketing concept. Baker and Sinkula (2002) in Karlíček *et al.* (2014) define market orientation as the degree to which a firm includes information about the external marketing environment into their strategic planning, or as the company's ability to learn from its environment. Karlíček *et al.* (2014) further states that market orientation takes into account both, the internal coordination within the organization, and the external environment – the customers (the existing and potential ones), competitors and the environment trends (economic, political, social, technological, legislative, etc.). This fulfils the mission of strategic management – to put resources and expertise into compliance with the opportunities in the markets. This work focuses on two major external market participants – the customers and competitors and the internal interplay of activities within the company.

The aim of Lado and Maydeu-Olivares (2001) research was to determine whether the relation between market orientation and innovation performance may be generalized despite different political and economical environments and cultural context. Lado and Maydeu-Olivares (2001) studied market orientation of insurance companies in the EU. However, no significant differences in market orientation among countries were found. the authors claim they found a significant match between the structure of market orientation factors among the studied countries. In order to measure results in the area of market orientation the authors used an instrument suggested by Lado *et al.* (1998) which consisted of 30 items. Innovation performance was measured by the help of a four-item scale by Atuahene-Gima (1996). the authors collected 137 responses from the EU and 74 from the USA consisting of top managers and the authors discovered statistically significant positive dependence between market orientation, the innovation degree and innovation performance. In their model Maydeu-Olivares and Lado (2003) determined that innovation performance, as an intermediate variable, considerably increases the influence of market orientation on total business performance; on the contrary, customer loyalty itself does not show any influence on this relationship. Smith *et al.* (2007) dealt with a comparison of market orientation in Chinese and American firms. the authors used a scale with 29 items that was created from the two best known measuring scales MARKOR and MKTOR.

Model of Market Orientation

The selected model includes four key dimensions: customer intelligence generation, competitor intelligence generation, intelligence dissemination & integration, responsiveness to market intelligence. Market intelligence generally includes useful information about stakeholders and market trends. Kozel *et al.* (2011) report that the main problem nowadays is not a lack of data but its arrangement so that the data could serve as the basis for the company's strategic decision-making. Karlíček *et al.* (2014) highlight three key activities of market orientation that reflect the typical reaction of the organization to its environment (generating relevant market information, its dissemination within the company and its integration in planning and execution of business activities). Mohr *et al.* (2010); Karlíček *et al.* (2013) further distinguish between a proactive and reactive market orientation, depending on whether it concentrates on detecting the needs of the current or future customers or examining the current and planned activities in firms using similar technologies, producing competitive products and focusing on the same group of customers.

Customer Intelligence Generation (CUIG)

Kohli and Jaworski (1990) define intelligence generation as obtaining information about "customers' needs and preferences". All customer-oriented companies should aim at understanding customers' expectations. the goal of high-tech firms, especially, is uncovering the so-called hidden customer needs. Active detection and understanding of customer needs helps to achieve higher customer satisfaction, and this approach certainly helps to build and strengthen the lifetime value of a customer. Where to obtain useful customer information? Mohr *et al.* (2010) for instance mention customer helplines, fairs, regular visits of customers, cooperation with universities, etc.

Competitor Intelligence Generation (COIG)

Continuous data collection and analysis of competitive strategies data is an important external source of information for the management, not only in high-tech companies. a wide range of sources (internal database, CRM, external data from agencies, mystery shopping, etc.) is available for market monitoring. the result is a comprehensive understanding of the current market situation, which may include the price of competing products, strategic plans of the competition, new job openings, names of distributors, managers, etc. Using relevant market knowledge the management can plan and organize key company activities with greater accuracy.

Intelligence Dissemination & Integration (IDI)

According to Mohr *et al.* (2010) the process of market information dissemination involves sharing or intelligence dissemination across the organization. Integration of information, incl. knowledge-based activities via the information acquired, is closely related to the process of intelligence dissemination. Dostál *et al.* (2005), Kozel *et al.* (2011) describe in detail the process of converting data into knowledge. Quality data can be obtained by carrying out a regular quantitative market research. Such data are to be understood, specified and integrated into a broader context and timeframe. An example may be primary demographic and socioeconomic data on the structure of the population and income in a given segment of the population. After a thorough statistical processing, interpretation and comparison with similar data in other regions such data can be seen as information or intelligence. Valuable information is often readily available via information technologies to all companies, and therefore, its value has somewhat decreased. For strategic decision-making and concrete coordinated action it is necessary to understand the broader context of the information obtained. Therefore this information must be transformed into knowledge. Such knowledge is crucial for the company and represents a real competitive advantage in the marketplace. Both formal, and informal meetings, conferences, e-mail and other communication enable sharing and integration of information within the company.

Responsiveness to Market Intelligence (RMI)

Kohli and Jaworski (1990) describe responsiveness as an action taken in response to market intelligence that is generated and disseminated. According to Mohr *et al.* (2010) it is strategic decisions of the company resulting from the collaboration between individual departments (coordinated action) and contributing to creating an added value between the company and the customer.

MATERIALS AND METHODS

Methodology

The selection of companies was based on the criteria according to CZ-NACE. To obtain the necessary data two company databases were used – Hoppenstedt and Albertina. the analyzed group consisted of responses from 164 Czech and 187 German executives of high-tech companies in the manufacturing industry. the responses were recorded on a seven-point Likert scale. the questionnaire items are shown in appendix. In the Czech settings the Czech version of a measuring scale of market-orientation MMOS with 12 items was used (in Germany, the English version of MMOS was used). the average return rate was around 15 % depending on the region, type and size of the company. the market orientation index was calculated as the arithmetic average of all items. the parameters in the model were estimated using the maximum likelihood method. Invariance testing was performed using the method of Multigroup Confirmatory Factor Analysis. the null hypothesis assumes that the surveyed submodels of market orientation in the Czech Republic and Germany do not differ. An alternative hypothesis assumes that the surveyed submodels of market orientation in the Czech Republic and Germany differ. the results were processed in IBM SPSS Statistics 21 and IBM SPSS AMOS 22.

High-tech sector

In the past many authors such as Baruch (1997), Zakrzewska-Bielawska (2010) or Zeleny (2012) dealt with definitions and exact specification of high-tech sector. According to Mohr *et al.* (2010, p. 9) high-tech firms can be defined as follows: "high-tech firms are those that are engaged in the design, development and introduction of new products and (or) innovative manufacturing processes through the systematic application of scientific and technical knowledge." a summary of definitional criteria of high-tech firms was drawn up in details by Kraftová and Kraft (2008). the most often mentioned characteristic features are

I: *High-tech manufacturing industries by CZ-NACE*

Production of pharmaceutical products and services (division 21)
Production of computers and electronically components (groups 26.1, 26.2)
Production of consumer electronics and optical instruments (groups 26.3, 26.4, 26.7, 26.8)
Production of measuring, testing, navigation and medical instruments (groups 26.5, 26.6)
Production of planes and their engines, spaceships and associated equipment (group 30.3)

Note: CZ-NACE (Classification of Economic Activities by Czech Statistical Office)
Source: Own elaboration

II: *Comparison of high-tech firms in manufacturing industry in Czech Republic and Germany*

Selected Indicators (2012)	Czech Republic	Germany
Number of Enterprises	3,507	8,418
Personnel Costs (millions of euro)	1,055.5	31,538
Wages and Salaries (millions of euro)	774.3	26,067.1
Number of persons employed	62,892	510,138
Number of employees	59,774	506,783
Share of personnel costs in production (%)	8.1	25
Average personnel costs per employee; (thousands of euro)	17.7	62.2
Growth rate of employment (%)	11.2	2.4
Number of persons employed per enterprise	17.9	60.6

Source: Own elaboration according Eurostat

the following: above-average number of employees with a university degree, high science and research costs, products based on advanced technology, high dynamic growth of yields, short lifetime cycle of products, high rate of innovation, etc. Generally, the high-tech branch can be divided into services and manufacturing industry which was the research subject of this study. the exact specification of high-tech industry is described in Table I. the major findings of the selected studies on the nature of the relationship between high-tech sector in Czech Republic and Germany are summarised in Table II.

Mohr *et al.* (2010) emphasize three activities of high-tech companies: identification of opportunities, product and process innovation, commercialization of the product. Also, in order to avoid volatility in high-tech companies, Mohr *et al.* (2006) list three sources of marketing myopia in high-tech markets: "our technology is so new that we have no competitors," "the new technology being commercialized by new competitors will pose a large threat," "that competitor is in a different industry, and their strategies don't/won't affect my business."

Invariance testing

In order to compare the research results across the selected groups it is, of course, necessary to make sure that the measurements are comparable. Within mutual comparison of the groups all the structural features in the model are systematically compared by gradually applying constraints or limitations. Weiber and Mühlhaus (2014) describe the individual stages of factorial invariance (see Table III). Model designation and parameter constraints are shown in detail in Figure 1 and Table IV.

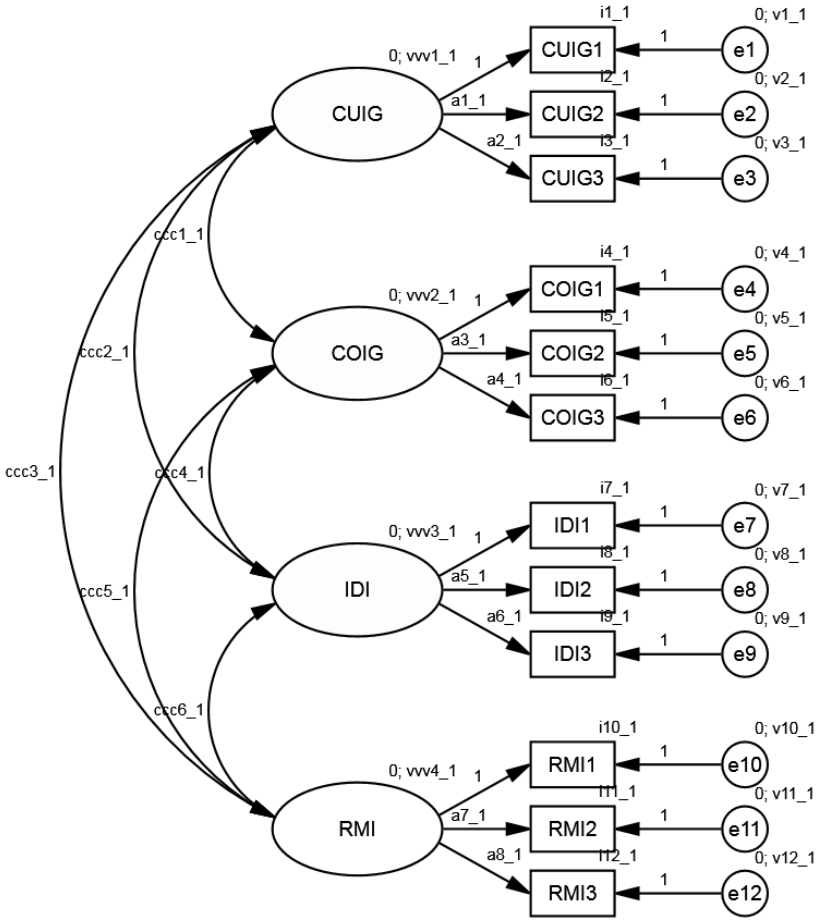
Invariance testing also allows for the assessment of validity and reliability of the measuring instrument. Cross-group validity of the measuring instrument is usually checked by going through a series of tests, where the demands for the equivalence of the measuring instrument are increased step by step, as we ask the following questions (see Table III). the last two questions secure equal reliabilities for the items and the complete measuring instrument across groups (Blunch, 2013). If the model with applied constraints shows properties of similar quality (fit) as the same model without them, then the given degree of invariance can be confirmed.

A detailed factor structure of the tested model is shown in the graphical form in Figure 1. the model consists of four latent factors and twelve manifest variables (Jangl, 2015a).

III: *Testing a measuring instrument for cross-group equivalence*

Model	Description	
Model 1	Basis model: the same structure is assumed	Is the model structure the same across groups? That is, is the graphic picture of the measurement model the same across groups?
Configural invariance		
Model 2	As model 1 + regression weights are assumed equal	Are the regression weights equal across groups? If so, the manifest variables are measured in the same scale units across groups.
Metric invariance		
Model 3	As model 2 + the intercepts are assumed equal	Are the item intercepts equal across groups? If, so, the manifest variables are measured on common interval scales.
Scalar invariance		
Model 4	As model 3 + the factor covariances are assumed equal	Are the factors interrelated in the same way across groups?
Factor covariance invariance		
Model 5	As model 4 + factor variances are assumed equal	Do the factors exhibit the same variation across groups?
Factor variance invariance		
Model 6	As model 5 + error variances are assumed equal	Are the error variances and covariances equal across groups?
Error variance and covariance invariance		

Source: Own elaboration according Blunch (2013, p. 203)



1: *Factor structure of the model of market orientation MMOM*
Source: Own elaboration

IV: *Model designation and parameter constraints*

MODEL 1 – CONFIGURAL INVARIANCE										
MODEL 2 – METRIC INVARIANCE										
Regression weights										
a1_1=a1_2	a2_1=a2_2		a3_1=a3_2		a4_1=a4_2		a5_1=a5_2		a6_1=a6_2		a7_1=a7_2		a8_1=a8_2
MODEL 3 – SCALE INVARIANCE										
Regression weights										
a1_1=a1_2	a2_1=a2_2		a3_1=a3_2		a4_1=a4_2		a5_1=a5_2		a6_1=a6_2		a7_1=a7_2		a8_1=a8_2
Regression Intercepts										
i1_1=i1_2	i2_1=i2_2		i3_1=i3_2		i4_1=i4_2		i5_1=i5_2		i6_1=i6_2		i7_1=i7_2		i8_1=i8_2
i9_1=i9_2	i10_1=i10_2		i10_1=i10_2		i12_1=i12_2								
MODEL 4 – SCALE INVARIANCE (PARTIAL)										
Regression weights										
a1_1=a1_2	a2_1=a2_2		a3_1=a3_2		a4_1=a4_2		a5_1=a5_2		a6_1=a6_2		a7_1=a7_2		a8_1=a8_2
Regression intercepts										
i1_1=i1_2	i2_1=i2_2		i3_1=i3_2		i4_1=i4_2		i5_1=i5_2				i7_1=i7_2		i8_1=i8_2
i9_1=i9_2	i10_1=i10_2		i10_1=i10_2		i12_1=i12_2								
MODEL 5 – FACTOR COVARIANCE INVARIANCE										
Regression weights										
a1_1=a1_2	a2_1=a2_2		a3_1=a3_2		a4_1=a4_2		a5_1=a5_2		a6_1=a6_2		a7_1=a7_2		a8_1=a8_2
Regression intercepts										
i1_1=i1_2	i2_1=i2_2		i3_1=i3_2		i4_1=i4_2		i5_1=i5_2				i7_1=i7_2		i8_1=i8_2
i9_1=i9_2	i10_1=i10_2		i10_1=i10_2		i12_1=i12_2								
Covariances										
ccc1_1=ccc1_2	ccc2_1=ccc2_2		ccc3_1=ccc3_2		ccc4_1=ccc4_2		ccc5_1=ccc5_2		ccc6_1=ccc6_2				
MODEL 6 – FACTOR VARIANCE INVARIANCE										
Regression weights										
a1_1=a1_2	a2_1=a2_2		a3_1=a3_2		a4_1=a4_2		a5_1=a5_2		a6_1=a6_2		a7_1=a7_2		a8_1=a8_2
Regression intercepts										
i1_1=i1_2	i2_1=i2_2		i3_1=i3_2		i4_1=i4_2		i5_1=i5_2				i7_1=i7_2		i8_1=i8_2
i9_1=i9_2	i10_1=i10_2		i10_1=i10_2		i12_1=i12_2								

Covariances												
ccc1_1=ccc1_2	ccc2_1=ccc2_2		ccc3_1=ccc3_2		ccc4_1=ccc4_2		ccc5_1=ccc5_2		ccc6_1=ccc6_2			
Variances												
vvv1_1=vvv1_2	vvv2_1=vvv2_2		vvv3_1=vvv3_2		vvv4_1=vvv4_2							
MODEL 7 – ERROR VARIANCE AND COVARIANCE VARIANCE												
Regression weights												
a1_1=a1_2		a3_1=a3_2		a4_1=a4_2		a5_1=a5_2		a6_1=a6_2		a7_1=a7_2		a8_1=a8_2
Regression intercepts												
i1_1=i1_2		i3_1=i3_2		i4_1=i4_2		i5_1=i5_2				i7_1=i7_2		i8_1=i8_2
i9_1=i9_2		i10_1=i10_2		i12_1=i12_2								
Covariances												
ccc1_1=ccc1_2		ccc3_1=ccc3_2		ccc4_1=ccc4_2		ccc5_1=ccc5_2		ccc6_1=ccc6_2				
Variances												
vvv1_1=vvv1_2		vvv3_1=vvv3_2		vvv4_1=vvv4_2								
Error variances												
v1_1=v1_2		v3_1=v3_2		v4_1=v4_2		v5_1=v5_2		v6_1=v6_2		v7_1=v7_2		v8_1=v8_2
v9_1=v9_2		v11_1=v11_2		v12_1=v12_2								

Source: Own elaboration

STATISTICAL RESULTS

6.1. Analysis of German companies

Analysis of Czech companies

At first glance no significant differences were found in the descriptive statistics, nor in the covariance matrix between the two groups. Tables V and VII show that the highest rating from the respondents was given to those variables that relate to obtaining customer information, while the managers least believed in themselves in the items related to responsiveness to the obtained market information in the form of coordinated action. Values smaller than 5.0 signal a potential for improvement in the company. It was subsequently tested invariance using Multigroup Confirmatory Factor Analysis method of maximum likelihood.

Verification of invariance

The basic invariance is configural. In case it does not meet this requirement, it is of no use to proceed with applying further constraints. Weiber and Mühlhaus (2014) state that invariance is configural if the following conditions are met, see. Table IX:

If configural invariance is supported then each model is tested against its parent model in accordance with Table X. Metrical invariance, scalar invariance, factor covariance invariance, invariance factor variance, error variance and covariance invariance, and possibly partial invariance are tested respectively. the sequence of the models begins from an unrestricted model that corresponds with the independent models between the Czech Republic and Germany. Each submodel has a further constraint added to the parameter group. Such restriction determines that all the parameters in the group are identical between the two models. the sequences of the model testing, including the results, are described in Table X.

The results of invariance (equivalence) verification are shown in Table X. the column χ^2 indicates the criterion for model and data fit testing. the $\Delta\chi^2$ column builds on the previous one and serves to determine significance (P). the criterion χ^2 is used in all parameters of the quality of the model. the models with a lower criterion value seem better. the most important result is the P column, which contains the so-called significance. This can be interpreted as the probability of an error, that the alternative hypothesis will be erroneously accepted when in fact the null hypothesis is valid. In this case, we speak of the probability of false acceptance of validity of the given invariance. the standard threshold for acceptance of the alternative hypothesis is: significance smaller than 5 %.

The Comparative Fit Index (CFI) is used for verification of the model and data fit. All models

V: *Descriptive statistics of market-orientation model of high-tech companies*

	CUIG1	CUIG2	CUIG3	COIG1	COIG2	COIG3	IDI1	IDI2	IDI3	RMI1	RMI2	RMI3
$\bar{x}$	5.70	5.93	5.61	5.05	4.98	5.45	4.98	5.31	4.79	4.85	4.72	4.35
SD	1.29	1.16	1.17	1.29	1.28	1.25	1.46	1.30	1.36	1.29	1.30	1.39
Level of MO	high	high	high	middle	low	middle	low	middle	low	low	low	low

Note: SD (standard deviation), $\bar{x}$ (mean), MO=Market Orientation < 5 (low level), <5; 5.5> (middle level), > 5.5 (high level
Source: Own elaboration

VI: *Variance, correlation and covariance matrix*

Items	CUIG1	CUIG2	CUIG3	COIG1	COIG2	COIG3	IDI1	IDI2	IDI3	RMI1	RMI2	RMI3
CUIG1	1.654	.870	.542	.289	.361	.331	.386	.557	.504	.373	.447	.302
CUIG2	.582**	1.349	.809	.482	.477	.410	.305	.556	.479	.365	.560	.441
CUIG3	.361**	.598**	1.358	.551	.666	.504	.320	.444	.373	.296	.455	.429
COIG1	.174*	.322**	.367**	1.659	.974	.838	.281	.447	.397	.496	.569	.596
COIG2	.219**	.321**	.446**	.591**	1.640	.932	.279	.328	.373	.578	.614	.683
COIG3	.206**	.283**	.346**	.521**	.583**	1.561	.176	.335	.457	.456	.480	.545
IDI1	.206**	.180*	.188**	.150*	.150*	.097	2.118	1.044	1.108	.739	.639	.572
IDI2	.334**	.368**	.293**	.267**	.197**	.218**	.552**	1.688	1.239	.708	.640	.514
IDI3	.289**	.304**	.236**	.228**	.215**	.270**	.562**	.704**	1.836	.753	.591	.673
RMI1	.225**	.244**	.197**	.299**	.350**	.339**	.393**	.422**	.430**	1.666	.899	.929
RMI2	.267**	.370**	.300**	.393**	.368**	.295**	.337**	.378**	.335**	.535**	1.696	.814
RMI3	.168*	.272**	.264**	.332**	.383**	.313**	.282**	.284**	.357**	.517**	.449**	1.939

Note: Covariances are above the diagonal, correlation coefficients below the diagonal, variances on the diagonal
** p<0.01; * p<0.05
Source: Own elaboration

VII: *Descriptive statistics of market-orientation model of high-tech companies*

	CUIG1	CUIG2	CUIG3	COIG1	COIG2	COIG3	IDI1	IDI2	IDI3	RMI1	RMI2	RMI3
$\bar{x}$	5.90	6.08	5.67	4.99	4.97	5.40	5.03	5.43	4.89	4.85	4.77	4.39
SD	1.02	1.06	1.10	1.38	1.44	1.29	1.46	1.23	1.28	1.30	1.33	1.51
Level of MO	high	high	high	low	low	middle	middle	middle	low	low	low	low

NOTE: SD (standard deviation), $\bar{x}$ (mean), MO=Market Orientation < 5 (low level), <5; 5.5> (middle level), > 5.5 (high level); Source: Own elaboration

VIII: *Variance, correlation and covariance matrix*

Items	CUIG1	CUIG2	CUIG3	COIG1	COIG2	COIG3	IDI1	IDI2	IDI3	RMI1	RMI2	RMI3
CUIG1	1.033	.603	.489	.348	.445	.295	.359	.275	.278	.274	.413	.259
CUIG2	.561**	1.116	.689	.412	.524	.339	.274	.377	.340	.275	.484	.417
CUIG3	.436**	.591**	1.216	.622	.683	.436	.176	.258	.203	.172	.447	.338
COIG1	.248**	.282**	.408**	1.914	1.398	1.134	.344	.435	.330	.550	.592	.741
COIG2	.304**	.344**	.430**	.701**	2.079	1.284	.320	.357	.352	.695	.607	.908
COIG3	.225**	.249**	.307**	.636**	.691**	1.660	.115	.079	.190	.495	.451	.672
IDI1	.239**	.176*	.108	.168*	.150	.061	2.177	.907	1.010	.532	.590	.608
IDI2	.219**	.289**	.190*	.255**	.200*	.050	.498**	1.522	1.004	.505	.465	.335
IDI3	.214**	.252**	.144	.187*	.191*	.116	.536**	.637**	1.632	.499	.460	.626
RMI1	.208**	.201**	.120	.307**	.371**	.296**	.278**	.315**	.301**	1.684	.930	1.045
RMI2	.307**	.346**	.305**	.323**	.317**	.264**	.301**	.284**	.271**	.540**	1.759	.880
RMI3	.169*	.262**	.204**	.356**	.418**	.347**	.274**	.181*	.326**	.535**	.441**	2.264

NOTE: Covariances are above the diagonal, correlation coefficients below the diagonal, variances on the diagonal ** p<0.01; * p<0.05; Source: Own elaboration

IX: *Comparison of selected psychometric properties*

Indicators	CZ	GER
Model shows an acceptable fit in each group	Yes	Yes
Factor loadings are greater than 0.6; p<0.05 or p<0.10	Yes	Yes
Correlation between the factors are less than 1 and are significant	Yes	Yes
Discriminant validity of the constructs in each group is determined	Yes	Yes

Source: Own elaboration

show CFI greater than 0.95 indicating a good quality of the models. ΔCFI symbolizes a decline in the CFI indicator against the compared model; values below 0.01 represent an insignificant difference. the decline is larger only in scalar equivalence and the index agrees with the test χ^2 of the compared model.

The RMSEA indicator (Root Mean Square Error of Approximation) describes the model and data fit. Models with a value below 0.05 are considered quality models. In this case, all models meet this criterion, but the worst value was detected in the model of scalar equivalence. the indicator values are only a selective estimate of the actual value for the entire sample, a confidence interval is therefore constructed. the column 90 % C.I. provides the interval, in which the real indicator RMSEA is located with the probability value of 0.9. the RMSEA indicator in each model, except for scalar equivalence, falls within the confidence interval of the parent model. Again, the result is in accordance with the model fit test.

The Akaike Information Criterion (AIC) assesses the model and data fit taking into account the size of the model (the number of parameters) and prefers models with fewer parameters. the smaller the AIC value, the better. As the restricted models have a smaller number of independent parameters, the AIC increases, although the criterion of the model fit is always greater in the restricted models than in the compared model. the only decrease of AIC was again recorded in the scalar equivalence model. the ΔAIC column provides the values of the change in AIC.

The Tucker Lewis index (TLI) shows the model and data fit. Values close to 1 indicate good models.

X: *The standard sequence of sub-models*

Model	χ^2 (df)	$\Delta\chi^2$ (Δdf)	P	CFI (ΔCFI)	RMSEA (90% C. I.)	AIC (ΔAIC)	TLI (ΔTLI)	Comparison
Model 1	118.852	-	-	0.98541	0.02612	286.85213	0.97994	-
Configural invariance	(96)	-		(-)	(-)	(-)	0	
Model 2	126.979	8.126	42.122 %	0.98533	0.02516	278.97853	0.98138	Model 1
Metric invariance	(104)	(8)		(0.00008)	(0; 0.03914)	(7.87360)	(-0.00144)	
Model 3	179.674	52.696	0.000 %	0.9593	0.0397	307.67	0.9537	Model 2
Scalar invariance	(116)	(12)		(0.02599)	(0.02781; 0.05068)	(-28.69578)	(0.02765)	
Model 4	143.099	16.120	13.673 %	0.98206	0.02646	273.09862	0.97941	Model 2
Scalar invariance (partial)	(115)	(11)		(0.00327)	(0.00649; 0.03952)	(5.87991)	(0.00197)	
Model 5	145.867	2.769	83.726 %	0.98412	0,02427	263.86737	0.98268	Model 4
Factor covariance invariance	(121)	(6)		(-0.00206)	(0; 0,03751)	(9.23125)	(-0.00327)	
Model 6	152.535	6.668	15.453 %	0.98242	0.02512	262.53501	0.98143	Model 5
Factor variance invariance	(125)	(4)		(0.00170)	(0.00288; 0.03797)	(1.33236)	(0.00125)	
Model 7	167.654	15.119	23.502 %	0.98043	0.02532	253.65351	0.98114	Model 6
Error variance and covariance invariance	(137)	(12)		(0.00199)	(0.00637; 0.03759)	(8.88150)	(0.00029)	

Source: Own elaboration

the index works with criterion of the model fit and the number of parameters. the lowest value of the TLI criterion was detected in the model of scalar equivalence, which also corresponds with the biggest decline against the compared model (ΔTLI).

The only rejected equivalence is therefore scalar equivalence. Other equivalences cannot be rejected. Only full scalar equivalence displays significance less than 5 %. Partial scalar equivalence differs from full scalar equivalence in one variable: *"We perform evaluation of strong and weak points of major competitors."*

DISCUSSION

Anýžová (2014) sees the formulation and translation of the model items and their subsequent interpretation as one of the causes of potential difficulties regarding comparability of the measuring scales. Therefore, invariance in two linguistically different scales was investigated. Within the models, the sequence of submodels was developed comparing differences between the two groups. a more detailed analysis led to the search for specific absolute terms that differ between the groups. the comparison of absolute terms of the models for the Czech Republic and Germany

shows that the biggest coefficient difference exists in the item: "*We perform evaluation of strong and weak points of major competitors.*" the sequence of submodels, which includes constraints of the absolute terms except for the aforementioned item, shows that all the other submodels are not significantly different. the same information was gathered from the model fit criteria (NFI, IFI, RFI, TLI). the criteria are based on χ^2 and therefore have a similar development.

This is the first survey of the kind, and therefore no other comparable study is available. Still, there are other studies on the measurement of invariance in market orientation. Ward, Girardi and Lewandowska (2006) dealt with a comparison of factor structure of the modified model of market orientation by Narver and Slater. They compared Australian, Dutch and Singaporean companies discovered that there was no statistically significant difference between the studied models. Zhou *et al.* (2007) compared member and non-member countries of the OECD (Organization for Economic Cooperation and Development). the configural, metric and scalar invariance measurement showed that customer orientation is invariant between member and non-member OECD countries and focus on the competition is partially invariant.

Furthermore, calculation of total market orientation index ($\bar{x}$ = 5.20 in the Czech Republic and x = 5.14 in Germany) and its comparison with results of similar measurement was carried out. Smith *et al.* (2007) used a different measuring scale for measurement of market orientation. Overall company performance calculated in the Czech Republic (x = 5.13) and Germany (x = 5.22) was slightly higher than in China, and at the same time lower than in the US. Smith *et al.* (2007) determined the average value in China x = 5.08 and in the USA x = 5.41. It has to be pointed out that managers from different continents may subjectively perceive the questions a bit differently. the use of Likert scale for evaluation of market orientation is also open to dispute. Since it is a subjective measurement, distortion of values may appear, however, no other method is de facto used in practise. Some authors measured on a five-point scale e.g. Kohli and Jaworski (1990), others such as Slater and Narver (1994) on a seven-point scale. Chalupský *et al.* (2009) used 52 items in total for measurement of market orientation of firms and the resulting value of index was (x = 5.2) using Tomášková's method. It follows that both ways of measurement show similar results, although they contain different dimensions.

The programme IBM SPSS AMOS version 22 was used to determine the Pearson correlation coefficient between variables (see Table VI and Table VIII). If the data contain extremes or exhibit asymmetry then using the Pearson coefficient may not be appropriate. In such a case for example Spearman coefficient may be used or the data is transformed. the data used in this study are of a subjective character ranging from 1 to 7. Therefore they do not contain extremely remote values and using Pearson coefficient is correct. Generally, there is an impression that subjective measures are inappropriate. There are, however, several good reasons for using them. the reasons in this regard are: (1) managers may be reluctant to disclose actual performance data if they consider it commercially sensitive or confidential, (2) subjective measures may be more appropriate than objective measures for comparing profit performance in cross-industry studies (Dawes, 1999). This is because profit levels can vary considerably across industries, obscuring any relationship between the independent variables and company performance. Subjective measures might be also more appropriate in this situation because managers can take the relative performance of their industry into account when giving their response (i.e. rate the profit performance of the company in relation to that of other companies); (3) performance measures such as profitability may not accurately indicate the underlying financial health of the company. Profitability may vary due to reasons such as the level of investment in R&D or marketing activity that might have long-term effects; and (4) there have been several studies that show a strong correlation between objective and subjective measures (Dess & Robinson, 1984).

Regardless of the measuring tool used, certain disinclination in the majority of managers to cooperate with universities and research institutes can be generally observed. Returnability of questionnaires in this study was about 14 % in the Czech Republic and 16 % in Germany. Other authors also have similar experience in the area of quantitative research, e.g. Gatignon and Xuereb (1997), who reached 14 % returnability of questionnaires, Spanjol *et al.* (2012) stated the rate of 11.2 % and Frambach *et al.* (2003) about 12.5 % in the market orientation research. Similarly, Oudan (2007) reports less than 20 % return rate in a quantitative research of market orientation and business performance.

CONCLUSION

In this study, both Czech high-tech firms (x = 5.20) and German high-tech firms (x = 5.14) seem to be medium market orientated. the models between the Czech Republic and Germany are almost identical. the model for the Czech Republic and Germany meets: configural invariance, metrical invariance, partial scalar invariance, factor covariance invariance, factor variance invariance, error variance and covariance invariance (the null hypothesis is accepted). However, the model does not meet: scalar invariance because it differs in a constant of the variable: "*We perform evaluation of strong and weak points of major competitors*." the alternative hypothesis is accepted. It can therefore be concluded that scales in both countries are equivalent with the exception of one item.

Acknowledgements

The Author is thankful to the Internal Grant Agency of FaME TBU No. IGA/FaME/2013/029 (Measurement of market orientation of a firm and development of a new model with a focus on contemporary trends in management and marketing) for the financial support of this research.

REFERENCES

ATUAHENE-GIMA, K. 1996. Market Orientation and Innovation. *Journal of Business Research,* 35(2): 93–103. doi: dx.doi.org/10.1016/0148-2963(95)00051-8.

ANÝŽOVÁ, P. 2014. Srovnatelnost Schwartzovy hodnotové škály v mezinárodních datech. *Sociologický časopis,* 50(4): 547–580.

BAKER, W. E. and SINKULA, J. M. 2002. Market Orientation, Learning Orientation and Product Innovation: Delving into the Organization's Black Box. *Journal of Market-Focused Management,* 5(1): 5–23.

BARUCH, Y. 1997. High technology organization – what it is, what it isn't. *International Journal of Technology Management, 13*(2): 179-195. doi: dx.doi.org/10.1504/IJTM.1997.001650.

BLUNCH, N. J. 2013. *Introduction to Structural Equation Modeling using IBM SPSS Statistics and Amos.* 2nd edition. Sage Publications.

CHALUPSKÝ, V., ŠIMBEROVÁ, I., TOMÁŠKOVÁ, E. and KAŇOVSKÁ, L. 2009. *Výzkum implementace tržní orientace u hi-tech firem.* Brno: FP VUT v Brně.

DAWES, J. 1999. The relationship between subjective and objective company performance measures in market orientation research: Further empirical evidence. *Marketing Bulletin,* 10: 65–76.

DESS, G. G. and ROBINSON JR., R. B. 1984. Measuring organizational performance in the absence of objective measures: The case of the privately-held firm and conglomerate business unit. *Strategic Management Journal,* 5: 265–273.

DOSTÁL, P., RAIS, K. and SOJKA, Z. 2005. *Pokročilé metody manažerského rozhodování: pro manažery, specialisty, podnikatele studenty, konkrétní příklady využití metod v praxi.* Praha: Grada Publishing.

FRAMBACH, R. T., PRABHU J. and VERHALLEN T. M. M. 2003. The influence of business strategy on new product activity: The role of market orientation. *International Journal of Research in Marketing,* 20: 377–397.

GATIGNON, H. and XUEREB, J. 1997. Strategic Orientation of the Firm and New Product Performance. *Journal of Marketing Research,* 34(1): 77-90. doi: dx.doi.org/10.2307/3152066.

HARRISON-WALKER, L. J. 2001. The measurement of a market orientation and its impact on business performance. *Journal of Quality Management,* 6(2): 139-172. doi:10.1016/S1084-8568(01)00035-9.

JANGL, P. 2015a. Model of Market Orientation of High-tech Firms in the Czech Republic. *Economics & Sociology, 8*(1): 106-118. doi:10.14254/2071-789X.2015/8-1/8.

JANGL, P. 2015b. The Effect of Market Orientation on Innovation of Czech and German High-Tech Firms. *Journal of Applied Economic Sciences,* X 2(32): 182–194.

JANGL, P. 2015c. Relationship between Market Orientation and Business Performance in Czech and German High-Tech Firms. *Trziste,* 27(2): 153–170.

JANGL, P. 2015d. Influence of the market orientation on business performance of high-tech firms in the manufacturing industry: Comparison of regression models of "market orientation – business performance" in the Czech Republic and Germany. *Journal of Applied Economic Sciences,* X 4(34): 484–493.

KARLÍČEK, M., et al. 2013. *Základy marketingu.* Czech Republic: Grada.

KARLÍČEK, M. NOVINSKÝ, M., TAHAL, R. et al. 2014. *Role marketingu ve firmách. Hlavní problémy, jejich příčiny a možné cesty řešení.* Radim Bačuvčík, VeRBuM.

KRAFTOVÁ, I., and KRAFT, J. 2008. High tech firmy a tvorba bohatství v zemích EMEA. *E+M Ekonomie a Management*, 4: 6–20.

KOHLI, A. K. and JAWORSKI, B. J. 1990. Market orientation: the construct, research propositions and managerial implications. *Journal of Marketing,* 54(2): 1–18.

KOZEL, R., MYNÁŘOVÁ, L. and SVOBODOVÁ, H. 2011. *Moderní metody a techniky marketingového výzkumu.* Praha: Grada Publishing.

KUMAR, R. 2011. *Research Methodology: A Step-by-Step Guide for Beginners.* 3rd edition. SAGE Publications Ltd.

LADO, N., and MAYDEU-OLIVARES, A. 2001. Exploring the link between market orientation and innovation in the European and US insurance markets. *International Marketing Review*, 18: 130–144.

LADO, N., MAYDEU-OLIVARES, A. and RIVERA, J. 1998. Measuring market orientation in several populations: a structural equations model. *European Journal of Marketing*, 32(1/2): 23–39.

MAYDEU-OLIVARES, A. and LADO, N. 2003. Market orientation and business economic performance. A mediated model. *International Journal of Industry Management*, 14(3): 284–309.

MOHR J. J., SENGUPTA S. and SLATER S. 2010. *Marketing of High-Technology Products and Innovations.* 3rd edition. Hamilton Printing.

MOHR, J. J., SLATER, S. and SENGUPTA, S. 2006. *Foundations for Successful High-Technology Marketing. Managing Technology and Innovation: An Introduction.* London: Routledge.

OUDAN, R. 2007. *Market Orientation.* 1st edition. VDM Verlag Dr. Mueller e.K.

SLATER, S. F. and NARVER, J. C. 1994. Does competitive environment moderate the market orientation performance relationship? *Journal of Marketing, 58:* 46–55.

SMITH, D. B., PITTA, D. A. and RICHARDSON, L. 2007. A Comparison of the Market Orientation of Chinese and US Firms. *International Business & Economics Research Journal*, 6(12): 25–38.

SPANJOL, J., MÜHLMEIER, S. and TOMCZAK, T. 2012. Strategic Orientation and Product Innovation: Exploring a Decompositional Approach. *Product Development & Management Association*, 29(6): 967-985. doi: 10.1111/j.1540-5885.2012.00975.x.

WARD, S., GIRARDI, A. and LEWANDOWSKA, A. 2006. A cross-national validation of the Narver and Slater market orientation scale. *Journal of Marketing Theory and Practice*, 14(2): 155–167.

WEIBER, R. and MÜHLHAUS, D. 2014. *Strukturgleichungsmodellierung. Eine anwendungsorientierte Einführung in die Kausal analyse mit Hilfe von AMOS, SmartPLS und SPSS.* 2nd edition. Springer Verlag.

ZAKRZEWSKA-BIELAWSKA, A. 2010. High Technology Company-Concept, Nature, Characteristics. In: *Recent Advances in Management, Marketing, Finances.* Penang: WSEAS Press, 93–98.

ZELENY, M. 2012. High technology and barriers to innovation: from globalization to relocalization. *International Journal of Information Technology & Decision Making,* 11(2): 441–456.

ZHOU, K. Z., BROWN, J., R., DEV, S. C. and AGARWAL, S. 2007. The effects of customer and competitor orientations on performance in global markets: a contingency analysis. *Journal of International Business Studies,* 38: 303–319.

The Modified Market Orientation Scale (MMOS) – English version

Construct	Items
Customers Intelligence Generation	We systematically collect and evaluate data about satisfaction or non-satisfaction of customers.
	We have regular meetings with customers in order to learn their future expectations in time.
	We permanently strive for a deeper understanding of the hidden needs and requirements of customers.
Competitors Intelligence Generation	We perform evaluation of strong and weak points of major competitors.
	We try to predict a future behaviour of competitors.
	We monitor mutually competing firms in our branch.
Intelligence Dissemination & Integration	We inform each other about successful and unsuccessful experience with customers across all company departments.
	In our company we hold a lot of formal and informal talks where we solve present business success, market opportunities or risks.
	Market information is integrated in this workplace before decisions are made.
Responsiveness to Market Intelligence	Our reaction to the competitor's price campaign is very short.
	Principles of market segmentation control development of new products in our firm.
	We react immediately if the competition launches intensive advertising campaign aimed at our customers.

Source: Own elaboration

Contact information

Patrik Jangl: jangl@seznam.cz