THE INFLUENCE OF USING ERP AND CRM SYSTEMS TO ECONOMIC OUTTURNS OF ENTERPRISES IN THE REGIONAL PERSPECTIVE

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Abstract

The goal of the article is to determine the influence of ERP and CRM systems on the economic results of businesses in relation to particular voivodships in Poland. The analysis involves the following variables: Number of companies using ERP software packages for transmitting information between different departments (e.g., accounting, marketing, production), Number of companies using CRM software to collect and storage information on customers as well as provide information access to other organizational units. Number of companies is using CRM, software that allows to analyse customer information for marketing purposes (pricing, promotional actions management, defining distribution channels, etc.), to manage customer information, Revenues from total activity, Revenues from sale of products, goods and materials, Gross financial result (balance). The data come from the years 2008, 2010 and 2012. To evaluate the effects of the application of ERP and CRM systems on the economic results of enterprises the panel model was used.

Keywords: ERP, CRM, economic outturns, modelling

1. INTRODUCTION

Companies operating on the market today have to be prepared for situations in which it becomes necessary to flexible response to changes in the environment. One of the elements that can enable them to active measures designed to raise their competitiveness is to use a variety of techniques that support corporate activities in various areas. Today there is a trend, indicating that it is especially important to collaborate with partners in the supply chain. To manage this process can be used in the form of software. One of them is to apply the concept of supply chain management SCM (Supply Chain Management), CRM, ERP concepts supported. SCM system allows the use of methods and tools and information necessary for the decision in respect of the implementation of the logistics. The data processed by SCM systems allow for their consolidation and exploitation in the form of ready information. The example of described relations is presented at **Fig. 1**.
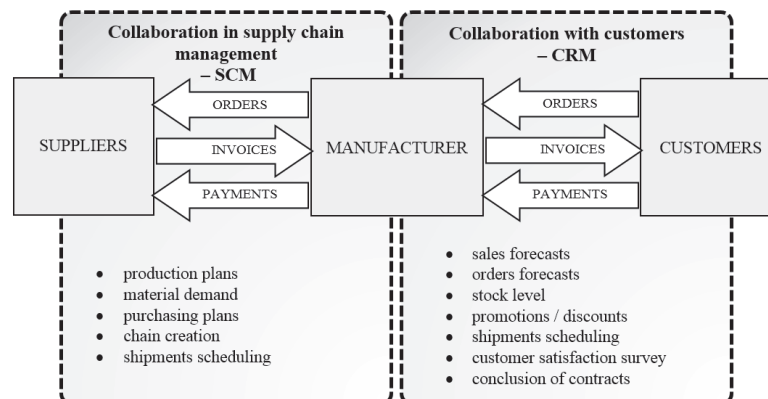

Fig. 1 Information integration of supply chain [1]

Depending on the relations among partners show indicated in the chain, which allows you to specify the tasks that are related to supply chain management. Supply chain management system includes operations

consisting of the individual planning of logistic processes such as demand forecasting, planning of material needs, creating customer relationships, supply chain flows in the coordination, monitoring and control of logistic processes, including purchases, sales, collecting and maintaining inventory, process control at the operational level in particular in the supply, transport and storage.

2. ERP AND CRM SYSTEMS

Analysis of issues related to supply chain management tools scheduling means the necessity and legitimacy of the exchange of information between the partners in the logistics chain. Information sharing is particularly important from the point of view of avoiding stocks of sub-optimisation called the result of Forrester effect. [2] Efficient management of migration flows requires:

- the reduction in stocks,
- the precise time of the supply of raw materials and semi-finished products,
- accurate determination of the production costs,
- better use of existing infrastructures (warehouses, manufacturing capabilities),
- faster response to changes in the environment,
- monitoring of the implementation of the various stages of production.

By managing ERP system it is possible to coordinate all relevant processes, both at the level of the supply chain and logistics system, as well as optimize and control. This solution is also used in all entities in the areas of financial management and controlling. In order to reduce internal administration costs, the implementation of coordination application work of individual branches, enables bookkeeping for several companies. Billing invoices between companies belonging to the company are generated on the basis of the carried out transaction marketing Material. To generate production orders arising from complex contracts by customers, the system can create a download list. Thanks to the distribution Department can generate the confirmation of orders and declare the delivery date directly on the client. This allows you to significantly reduce order processing time. [3]

CRM (Customer Relationship Management) is a response to the changes taking place since the early 1980s on the market and on the revision of the classic concept of marketing. This is a management model, in which the focus of the organization is the customer, and the priority is the development of appropriate relationships with him. Prerequisites for the introduction of the concept of CRM are: more and less customer loyalty, increase employee turnover commercial departments, the increase of competition, increasing costs to acquire new customers, increasing experience and customer requirements to suppliers, greater flexibility of production-faster introduction of new products on the market, but also new competitors can quickly appear on the market and introduce their products, the dispersal of advertising channels-a multitude of new media (the new tv stations , Internet, etc.) cause that to succeed you need a mass advertising in diverse media, an increase in the number of distribution channels (the big commercial networks, the company's leading direct sales, Internet, etc.). [4]

CRM as a business strategy is based on level and managing clients, giving you the ability to achieve long-term benefits. CRM system requires the introduction of a philosophy and business culture aimed at the client, providing effective processes of marketing, sales and service. It gives the possibility of effective customer relationship management leading to the primacy of this approach in the framework of an overall strategy and corporate culture. The overall goal of the organization using the principles of CRM is to ensure customer satisfaction, trust and maintenance and customer loyalty, and the best possible use of their potential by the formulation of products and deals. The benefits of using CRM are: to increase sales, reduce time spent on administrative activities of retailers, increasing the efficiency of operations-sales, reducing variable costs, lowering the cost of recruiting and training of Staff. [5]

3. DATA AND REASERCH METHODOLOGY

The analysis is based on data from the Central Statistical Office in Poland. The following variables were taken into account:

- ERPS - number of companies using ERP software packages for transmitting information between different departments (e.g., accounting, marketing, production),
- CRMA - number of companies using CRM, software which allows the collection and storage of customer information as well as providing access to such information to other organizational units, to manage customer information,
- CRMM - number of companies using CRM, software that allows analyzing customer information for marketing purposes (pricing, promotional actions management, defining distribution channels, etc.), to manage customer information,
- RTA - revenues from total activity (in mln PLN),
- RSA - revenues from sale of products, goods and materials (in mln PLN),
- GFR - gross financial result (balance) (in mln PLN).

Variables ERPS, CRMA, CRMM represent a collection of potential explanatory variables, while variables RTA, RSA, GFR are a collection of variables response. Determine the level of the economic effects of undertakings in individual voivodeships in Poland. The adoption by the variables explained the data concerning the economic results of enterprises at different levels of aggregation has to verify the relationship between the effects of the business activities and the use of ERP and CRM. It should be remembered that the purpose of the implementation of IT systems in the enterprise is not only streamline business processes, but also to increase the efficiency of economic activities measured economic results. The data comes from the database of the main statistical office. Data were analysed for the years 2010-2013 for individual provinces. To determine the impact of explanatory variables on the individual variables explained uses of low-density models. Estimated parameters of three models on the basis of which studied the impact of explanatory variables highlighted:

- the level of revenues from total activity (RTA),
- the level of revenues from sale of products, goods and materials (RSA),
- the level of gross financial result (GFR).

In the first stage of the analysis the parameters of the models estimated a (OLS) ordinary least squares method). In order to ascertain the legitimacy of the use of OLS for model estimation was performed tests: Breuscha-Pagana, quiet street, the total relevance of inequality sized groups. Breuscha test-verify the existence of a hypothesis allows Pagana individual effect. The test examines the correlation between explanatory variables prevalence Hausmannian and random effects.

4. DATA ANALYSIS

The study suggested three one-equation models that describe the relationship into the level of revenues from total activity (1) or the level of revenues from sale of products, goods and materials (2) or the level of gross financial result (3) and the degree of use of different types of information systems, in support of the activities of the companies.

$$RTA_{it} = \alpha_{i1} + \alpha_1 ERPS_{it} + \alpha_2 CRMA_{it} + \alpha_3 CRMM_{it} \tag{1}$$

$$RSA_{it} = \alpha_{i1} + \alpha_1 ERPS_{it} + \alpha_2 CRMA_{it} + \alpha_3 CRMM_{it} \tag{2}$$

$$GFR_{it} = \alpha_{i1} + \alpha_1 ERPS_{it} + \alpha_2 CRMA_{it} + \alpha_3 CRMM_{it} \tag{3}$$

It is: i - means the voivodeship, t - each year of the period considered 2010-2013.

Table 1 OLS estimation and verification results of the models for *RTA* response variable

Variable	Parameter estimate	Standard error	Student's *t* statistics	Significance level *p*
const	−66217.4	13918.5	-4.7575	0.00002
CRMM	342.529	15.6786	21.8469	<0.00001
mean of dependent variable 164718.5 standard deviation of dependent variable 209320.8				
residual sum of squares 1.81e+11 standard error of residual 62732.26				
determination coefficient R2 0.912094 adjusted R2 0.910183				
F(1, 46) 477.2881 significance level p for F test 6.31e-26				
Log likelihood −597.3259 Akaike criterion 1198.652				
Schwarz criterion 1202.394 Hannan-Quinn criterion 1200.066				
residual autocorrelation - rho1 0.828952 DW statistic 0.285212				

Source: Own calculation in GRETL

Table 2 OLS estimation and verification results of the models for RSA response variable

Variable	Parameter estimate	Standard error	Student's *t* statistics	Significance level *p*
const	−61720.1	12985.7	−4.753	2.00e-05
CRMM	326.537	14.6278	22.32	2.54e-026
mean of dependent variable 158434.0 standard deviation of dependent variable 199177.7				
residual sum of squares 1.58e+11 standard error of residual 58528.01				
determination coefficient R2 0.915490 adjusted R2 0.913653				
F(1.46) 498.3166 significance level p for F test 2.54e-26				
Log likelihood −593.9961 Akaike criterion 1191.992				
Schwarz criterion 1195.735 Hannan-Quinn criterion 1193.407				
residual autocorrelation - rho1 0.820209 DW statistic 0.292248				

Source: Own calculation in GRETL

Table 3 OLS estimation and verification results of the models for GFR response variable

Variable	Parameter estimate	Standard error	Student's *t* statistics	Significance level *p*
const	−3013.34	740.979	−4.067	0.0002
CRMM	15.5566	0.834681	18.64	4.54e-023
mean of dependent variable 7475.048 standard deviation of dependent variable 9661.713				
residual sum of squares 5.13e+08 standard error of residual 3339.676				
determination coefficient R2 0.883061 adjusted R2 0.880519				
F(1.46) 347.3665 significance level p for F test 4.54e-23				
Log likelihood −456.5418 Akaike criterion 917.0836				
Schwarz criterion 920.8260 Hannan-Quinn criterion 918.4979				
residual autocorrelation - rho1 0.703824 DW statistic 0.572676				

Source: Own calculation in GRETL

On the basis of the tests: Breuscha-Pagana, quiet street, the total relevance of inequality group applicability found average OLS to parameter estimation models. The results of the tests for individual models are presented in **Table 4**.

Table 4 Results of statistic tests for estimated models

Explained variable of model	Breusch-Pagan test statistic		Hausman test statistic		Significance of group mean differences	
	LM	*p*	*H*	*p*	*F*	*p*
RTA	30.1149	4.07193e-008	17.901	2.327e-005	27.5638	8.85219e-014
RSA	29.6361	5.21257e-008	19.177	1.19138e-005	27.7053	8.24003e-014
GFR	18.2809	1.90605e-005	**0.242082**	0.622707	6.09808	1.12586e-005

Source: Own calculation in GRETL

Analyzing the results obtained one can therefore conclude that, for count OLS estimation models is not allowed. For models with explanatory variables to the RTA and RSA use models with fixed effects, for a model with a more appropriate model with random effects would be GFR. In tables 5 and 6 are estimates of models with variable response RTA and RSA after the introduction of the fixed effect.

Table 5 Estimation results of the model with fixed effects for RTA response variable

Variable	Parameter estimate	Standard error	Student's *t* statistics	Significance level *p*
const	69862.5	16045.0	4.354	0.0001
ERPS	71.4188	15.0439	4.747	4.75e-05
CRMM	65.1424	33.8227	1.926	0.0636

mean of dependent variable 164718.5 standard deviation of dependent variable 209320.8 residual sum of squares 7.21e+09   standard error of residual 15502.50

determination coefficient R^2 0.996499   adjusted R^2 0.776782

$F_{(17, 30)}$ 502.2817 significance level *p* for *F* test   4.15e-32

Log likelihood −519.9693   Akaike criterion 1075.939

Schwarz criterion 1109.620 Hannan-Quinn criterion 1088.667

residual autocorrelation - rho1 −0.225845 *DW* statistic 1.371847

Joint test on named regressors

$F_{(2, 30)}$ = 52.1988 with *p* value p = $P(F_{(2, 30)} > 52.1988)$ = 1.70193e-010

Test for differing group intercepts

Null hypothesis: The groups have a common intercept

Test statistic: $F_{(15, 30)}$ = 47.5036

p value = $P(F_{(15, 30)} > 47.5036)$ = 9.44929e-017

Source: Own calculation in GRETL

Table 6 Estimation results of the model with fixed effects for RSA response variable (Source: Own calculation in GRETL)

Variable	Parameter estimate	Standard error	Student's *t* statistics	Significance level *p*
const	110122	27889.5	3.949	0.0005
ERPS	73.9853	14.2098	5.207	1.43e-05
CRMA	72.2430	30.8604	2.341	0.0263
CRMM	−58.4201	33.2871	−1.755	0.0898

mean of dependent variable 158434.0   standard deviation of dependent variable 199177.7

residual sum of squares 5.65e+09   standard error of residual 13957.84

determination coefficient R2 0.996970   adjusted R2   0.801906

$F_{(18, 29)}$ 530.0931 significance level p for F test   1.18e-31

Log likelihood −514.1176   Akaike criterion 1066.235

Schwarz criterion 1101.788 Hannan-Quinn criterion 1079.671

residual autocorrelation - rho1 −0.163658 DW statistic 1.315616

Joint test on named regressors

$F_{(3, 29)}$ = 39,1317 with p value p = $P(F_{(3, 29)} > 39.1317)$ = 2.5365e-010

Test for differing group intercepts

Null hypothesis: The groups have a common intercept

Test statistic: $F_{(15, 29)}$ = 50.2233

p value p = $P(F_{(15, 29)} > 50.2233)$ = 1.15412e-016

The results of the tests Breuscha-quiet street and variable model Pagana explanatory GFR indicates the compatibility of both estimators: for fixed effects and random effects, random-effects estimator is more efficient. **Table 7** shows the results of model estimation with variable explanatory GFR following the introduction of the random effect.

Table 7 Estimation results of the model with random effects for GFR response variable

Variable	Parameter estimate	Standard error	Student's t statistics	Significance level p
const	−3210.64	1097.18	−2.926	0.0054
ERPS	−4.35488	1.62901	−2.673	0.0104
CRMM	20.4560	2.25883	9.056	1.06e-011

mean of dependent variable 7475.048   standard deviation of dependent variable 9661.713
residual sum of squares 5.04e+08   standard error of residual 3310.374
Log likelihood −456.1188   Akaike criterion 918.2376
Schwarz criterion 923.8512   Hannan-Quinn criterion 920.3590
'Within' variance = 3.41003e+006
'Between' variance = 8.90172e+006
theta used for quasi-demeaning = 0.64266
Breusch-Pagan test:
Null hypothesis: Variance of the unit-specific error = 0
Asymptotic test statistic: Chi-square(1) = 22.1089
with p value = 2.57611e-006
Hausman test:
Null hypothesis: GLS estimates are consistent
Asymptotic test statistic: Chi-square(2) = 2.72602
with p value = 0.255889

Source: Own calculation in GRETL

5.   CONCLUSIONS

In conclusion, the analysis undertaken of the following conclusions can be drawn:

1**.**   for the model with the variable response RTA:
- for the level of revenues from total activity statistically significant variables influence: Number of companies using ERP software packages for transmitting information between different departments (e.g., accounting, marketing, production) and Number of companies using CRM, software that allows analyzing customer information for marketing purposes (pricing, promotional actions management, defining distribution channels, etc.), to manage customer information,
- all these variables are positively (positively) correlated with revenues from total activity,
- the use of both types of systems causes a similar increase in the level of revenues from total activity,

2.   for the model with the variable response RSA:
- a statistically significant impact on the level of revenues from sale of products, goods and materials they have all the explanatory variables are highlighted, and thus use all types of systems supporting business enterprises affect the result in terms of sales,
- the increase in Number of companies using ERP software packages for transmitting information between different   departments (e.g., accounting, marketing, production) and Number of companies using CRM, software which allows the collection and storage of customer information as well as providing access to such information to other organizational units, to manage customer information causes the average increase revenues from sale of products, goods and materials,

While the increase in Number of companies using CRM, software that allows analyzing customer information for marketing purposes (pricing, promotional actions management, defining distribution channels, etc.), to manage customer information causes the average decline revenues from sale of products, goods and materials,

3. for the model with the variable response GFR:
    - only Number of companies using ERP software packages for transmitting information between different departments (e.g., accounting, marketing, production) and Number of companies using CRM, software that allows analyzing customer information for marketing purposes (pricing, promotional actions management, defining distribution channels, etc.), to manage customer information have a statistically significant impact on the level of gross financial result,
    - the impact of the Number of companies using CRM, software that allows analyzing customer information for marketing purposes (pricing, promotional actions management, defining distribution channels, etc.), to manage customer information There is a positive (positive), but impact Number of companies using ERP software packages for transmitting information between different departments (e.g., accounting, marketing, production) is negative.

The analysis undertaken showed that all types of systems to support the business processes of enterprises have an impact on financial results. Unfortunately, this impact is not always a positive. It was found that ERP systems contribute to a reduction in the level of gross financial result, but CRM systems used in marketing purposes have a negative impact on the level of revenues from sale of products, goods and materials. The decline in financial performance caused by these two types of systems to due compensation, however, is the increase in financial performance as a result of the application of other systems. This decrease may be the result of a poorly conducted procedure accustomed systems companies, possibly with the inability of their full use by policy makers. In future studies, the authors imply an analysis of the factors which reduce the effectiveness of the implementation of ERP and CRM.

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