

**ASSOCIATION BETWEEN LOGISTICS AND FINANCIAL
PERFORMANCE: THE CASE OF CROATIAN “BEST-OF-BREED”
ENTERPRISE RESOURCE PLANNING (ERP) USERS**

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In the era of global business, supply chains become ubiquitous and critical elements of business performance, since contemporary organizations try to improve the performance of their logistics. This optimization is often attempted by introducing modular ERPs, which represent a promising tool for achieving both superior performance in the fields of logistics (as well as other individual functions) and the corporate level. The aim of this study is to assess whether there is a cumulative effect of performance improvement, which flows from a specific functional field of logistics (measured by adequate functional indicators) to the corporate level (measured by the indicators of corporate profitability, including Return on Assets - ROA, Return on Equity – ROE and Return on Sales – ROS). In addition, it will be tested whether the choice of an ERP vendor affects the performance effects in the analyzed sample. The analysis was performed on an indicative sample of 52 large Croatian companies – users of major “best-of-breed” ERP packages.

1. INTRODUCTION

Although widely available, Enterprise Resources Planning (ERP) software has been often “taken for granted” as the most complex and sophisticated tool for contemporary enterprise management, which ensures the realization of the competitive advantage¹. However, the mere possession of a software system, which might even be inappropriately or poorly used, can only create a

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¹ Competitive advantage is defined by Tipurić (1999, p. 3.): “(...) by possession or building up particular features that customers demand and accept and by which the company differs from the competition”, emphasizing that its „relative character (...) entirely eliminates any consideration of absolute values“, because “competitive advantage can be perceived only in the context of competition”.

competitive parity, if it is used without proper post-implementation customization and alignment of the software system and the organizational characteristics (Beard & Sumner, 2004). According to this view, the usage of a “generic” tool of any kind (including the advanced Information Technology – IT solutions) cannot grant competitive advantage, especially if the most sensitive enterprise resource is not deeply involved in the process, which refers to the employees, within their institutional and cultural environment. In order to contribute to the discussion about the performance and strategic effects of the ERP system, in this study, the cumulative effects of their functioning will be explored, so as to analyze whether the function-level performance gets translated into the corporate level. In addition, it is also interesting to see whether this effect is dependent on the ERP vendor (i.e. the type of software used).

Although it could be expected that the cumulative effects of performance improvement would emerge, the differences related to individual ERP vendors are not expected if the analyzed companies have developed successful approaches to ERP implementation. This is a logical consequence of Carr’s (2003) hypothesis that IT does not “automatically” lead to competitive advantage, but rather that it may provide different business benefits, if its costs are kept low (controlled). Such a theoretical viewpoint supports the idea that the software itself is a useful tool, which could create both operational and strategic benefits (Seddon, 2005) and which allows achievement of superior performance and competitive advantage, which should be created by the implementation and post-implementation of the ERP project and enterprise management. Therefore, it has been suggested that IT tools (including ERP systems) represent a capability, which should be optimized in terms of implementation and usage, if an enterprise is to turn it into a competitive advantage (Carr, 2003; Kankamedala et al., 2003).

2. SUPPLY CHAIN AND ENTERPRISE RESOURCE SYSTEMS PERFORMANCE ISSUES

Electronic (e-) exchange of the information has been enabled by the development of the IT and communication techniques, as well as by their application and the way they are used. Their proper implementation and availability have provided entirely new structures of business cooperation and accelerated time-to-market for products and services. The significance of the contemporary information systems emphasizes the need of their users to direct and shape the behavior of the business environment. This process is interactive and persistent (Panian et al., 2003, p. 73).

Under the permanent pressure of achieving particular business goals, short term – the profit and long term – the sustainability, management is constantly exposed to the internal and external influences of the environment which, according to Porter's model of five competitive forces, consists of (Kangas, 2003, p. 31.):

- the existing competition pressures,
- potential competitors (new entrants into the industry),
- competitive threat of substitute products/services,
- competitive threat from the existing customers and
- competitive threat from the existing vendors (both arising from their negotiating strength).

The cooperation of companies by securing memberships in organized supply chains is an effort towards achieving a range of strategic goals, depending on the industry in which an enterprise competes (see Table 1). Such a diversity of goals is reflected from a wealth of different contexts, in which the terms supply chain/supply chain management are used, which has also influenced the academic discussions. According to Mentzer et al. (2001), the very existence of a supply chain presupposes a certain level of strategic alignment among the connected organizations, engaged in the common production of value for the end consumer (also being a member).

Since almost all companies participate in the supply chains at various levels of cooperation, from spot market to common planning, they need to perform common logistics tasks, i.e. create flows of materials, goods and services, required to assure the efficient execution of business process, until the customer has been served. The material flows need to be associated with the exchange of information and coordination of individual activities of the supply chain members, if the supply chain is to be successful. This means that, in the globalized business environment, logistics cannot be strongly differentiated from the supply chain, as pointed out by Lambert et al. (2009, p. 67): *“Logistics is that part of the supply chain process that plans, implements, and controls the efficient, effective flow and storage of goods, services, and related information from the point-of-origin to the point-of-consumption in order to meet customers’ requirements.”*

This also involves a common information infrastructure and a shared managerial practice, covering the common logistics for all members of the supply chain, which is usually referred to as the Supply Chain Management – SCM (Mentzer et al., op. cit.). Therefore, in the further analysis, the terms “logistics performance” and “supply chain performance” will be used as

synonyms, since the IT usage context assumes the existence of information exchange between supply chain members and coordination of their logistics activities.

Table 1. Supply chain goals

Supply chain goals	Manufacturer Perspective	Material Supplier Perspective
	<ul style="list-style-type: none"> • Improve inbound operations • Reduce costs • Reduce inventory • Improve quality • Reduce lead time • Stabilize supply and price • Increase utilization of supplier's technology and expertise • Shorter concept to market product development 	<ul style="list-style-type: none"> • Increase sales volume • Increase customer loyalty • Provide value-added service • Increase switching costs • Reduce costs
	Manufacturer Perspective	Distributor Perspective
	<ul style="list-style-type: none"> • Increase sales volume • Increased availability • Increased freshness • Reduced damage • New product innovation • Lower inventory costs • Less damage • Invoicing accuracy • Improved pricing/promotions • Improved customer service • Improved order commitment 	<ul style="list-style-type: none"> • Increased profitability • Reduced inventory • Increased turns • Fresher product • Reduced delivery cost • Tailored product • Configuration • Improved consumer value
	Manufacturer Perspective	Service Supplier Perspective
	<ul style="list-style-type: none"> • Improve coordination between transportation operations and product supply • Reduce carrier base • Breakthrough reductions in costs • Breakthrough improvements in service • Improve warehousing and distribution labor productivity and space utilization • Maintain flexibility in product supply • Achieve consolidation benefits • Build support for industry wide supply chain initiatives 	<ul style="list-style-type: none"> • Increase market share growth in key accounts • Manage operational variability • Provide value-added service • Increase profitability • Develop closer relationships with industry leaders • Satisfy manufacturer customers • Ensure future competitive positioning

Modified from: Handfield & Nichols (2002), pp. 156-159.

This point has been raised by previous research, with the theoretical argument of the first ERP systems being internally oriented, with the focus on implementation and company-wide integration of functional data, while their further development was “naturally” oriented toward the supply chain, as the Internet enabled wide inter-organizational connectivity (Davenport & Brooks, 2004). This has also led to studies linking empirical performance of shared/connected logistics (i.e. supply chain) and the entire company to the usage of relevant information systems (Wieder et al., 2006).

The efficient supply chains are linking companies internationally, which creates a new dimension of strategic performance improvement by the globalization of manufacturing. Globalization offers performance improvements by enabling supply chain members to find and exploit cheaper resources, cut through-put times and increase turns. Vendors and customers are connected globally by the usage of shared information sources, which also reduces the risks of conducting international business (Harris, Heron & Iwanicki, 2006). In addition, IT creates opportunities for forming global virtual teams, which significantly contribute to product development (Schmidt, Montoya-Weiss and Massey, 2001) and other business processes within the supply chain.

Nevertheless, **all these opportunities need to be converted into the actual performance improvement**, if the IT systems fulfill their business role. In this study, the performance of the logistics function will be analyzed in a sample of Croatian ERP users, by following the approach of the previously cited study by Wieder et al. (op. cit.), who hypothesize the following: ERP-related measures → supply chain (shared and cooperative logistics) processes Key Performance Indicators (KPIs) → firm-level KPIs. It is especially interesting to follow up on the cited study, which demonstrates that the usage of ERP systems has adequate effects at the level of supply chain, while firm-level financial effects appear, but with a much longer lag (of four to five years) than reported by the previous literature.

Other previous studies have established some relationships between the Enterprise Resource Planning Systems (ERPS), as well as specialized Supply Chain Management Systems (SCMS) and different indicators of the logistics (process) and firm-level performance (see Table 2).

There is a whole range of theoretically relevant indicators of logistics performance (Gunasekaran, Patel and McGaughey, 2004), but the available empirical databases for Croatia limit their applicability for this study. According to the classical profitability KPIs, related to firm-level financial performance

(including return on sales – ROS, return on equity – ROE and return on assets – ROA) can be easily retrieved for the majority of analyzed enterprises and have been previously used in the assessment of ERP influence on performance (see e.g. Hunton et al., 2003). In addition, competitive advantage is traditionally measured by analyzing the existence of long-term above-average profitability of the leading enterprise (Grant, 2013), which provides another argument for the usage of the profitability metrics.

Table 2. KPIs used for evaluation of the implementation of the ERP systems (ERPS)

KPIs	Inventory turns	ROI	Income per employee	Number of employees	ROA	External communication - SCMS instead of ERPS	Costs per employee	Costs of inventory	Throughput time	Misdelivery	ROS	ROE	Liquidity
Kankamedala (2003)	+	+											
Poston and Grabski(2001)			+	-									
Hunon et al. (2003)		0			0								
Matolcsy et al. (2005)	+										+		+
Nicolau et al. (2003)			+										
Davenport & Brooks (2004) and Stefanou (2001)						+							
Supply Chain Council"							-	-	-	-			

Note: "+" positive influence established; "-" negative influence established; "0" no relationship established

Adapted from: Wieder et al. 2006., p. 18 and own research

In a study of large Croatian companies (Rendulić, 2011), management of the ERP users and supply chain participants estimated higher in average, although without statistical significance, further achievements:

- adequacy of the packing materials,
- alignment of the material flow with production,
- physical identification of the products,
- duration of the commercial activities (sales and purchasing).

It indicated improvements in activities which demand mass processing of the variety of the data in real time.

4. RESEARCH METHODOLOGY

According to the methodology of previous researches, the following hypotheses were drawn:

Hypothesis 1 (H1): There is a statistically significant association between logistics and financial performance in the population of Croatian ERP users.

Hypothesis 2 (H2): The type of enterprise software used and the ERP vendor providing it do not have significant performance effects among the Croatian ERP users.

Relying on the previous market research reports and various secondary data sources, including annual reports, publications of the Croatian Chamber of Economy, publications of the global ERP suppliers, etc., users of the ERP software in Croatia were identified. The author collected data related to 52 Croatian companies, using the “best-of-breed” ERPs software of the three major international vendors (Microsoft Navision, Oracle, SAP).

Their financial data for the fiscal years 2010 and 2011 were retrieved from the Croatian financial agency (FINA – Financial Agency) and the Web portal “Poslovna Hrvatska” (“Business Croatia”), which provides financial reports on all registered companies in Croatia. Performance data were used to calculate the previously described KPIs for the functional area of logistics/supply chain, as well as for the firm-level profitability.

The KPIs used for assessing the logistics/supply chain performance, which could be easily calculated from the available data, included inventory turns (following Kankamedala, 2003; Matolcsy et al, 2005, etc.), as well as material costs per employee (used as approximation of the logistics costs). The statistical analysis has been performed by using SPSS (Statistics Package for Social Sciences) and Microsoft Excel.

5. RESULTS OF THE EMPIRICAL RESEARCH

The sample consisted of 52 Croatian companies of all sizes, which were identified as ERP users, with the user status and the financial performance data, which could be obtained/confirmed from the publicly available sources. The size of the sample was relatively small, due to the relatively small size of the Croatian economy and the limited acceptance of ERP software packages, due to their size, cost and complexity (namely, according to the third-party market research data², the worth of the Croatian ERP software market grew to 212.1

² Source: <http://wire.seenews.com/news/croatias-erp-applications-market-expands-2-3-in-2012-idx-351906> (retrieved in November 2013).

million HRK (approximately 36.5 million USD), which is a very small amount, as compared to the global value of the ERP market, valued at 24.5 billion USD³.

Out of the 52 analyzed companies, 7.7% were small companies, 28.8% were mid-sized and 63.5% large enterprises. The mean number of employees for companies in the sample equaled 877, mean balance sheet value (in 2011) equaled 1.941.735.042 HRK (approximately 258.898.006 EUR) and the mean annual revenues (in 2011) had the value of 1.381.587.406 HRK (approximately 184.211.654 EUR).

In order to assess the statistical methods required for further analysis, it was tested whether the variables included into research conformed to fundamental assumptions for parametric analysis, especially to the assumption of normal distribution.

For the majority of observed variables (except for inventory turns, significant Kolmogorov-Smirnov one-sample test values showed that their distribution did not follow the normal distribution, which required a further use of nonparametric statistical methods (see table below).

Table 3. Kolmogorov-Smirnov one-sample test of the one-sample values

	Inventory turns 2011	Material costs per employee 2011	ROA 2011	ROE 2011	ROS 2011
N	52	52	52	52	52
Kolmogorov-Smirnov Z	1,092	1,613	3,280	3,328	3,208
Asymp. Sig. (2-tailed)	.184	.011	.000	.000	.000

a. Test distribution is Normal.

Source: Empirical research results

The first analysis performed was related to the mutual dependence of different performance indicators, as to test whether “success breeds success“, i.e. if different dimensions of logistics and financial performance (i.e. profitability) were mutually dependent.

This is true for the case of the two observed logistics performance indicators, when their values were analyzed by means of Spearman (rank-

³ Source: <http://dartongroup.com/worldwide-erp-market-share/> (retrieved in November 2013).

based) correlations, which demonstrated moderate and highly significant statistical association (see Table 4).

Table 4. Spearman (rank-based) correlations of the one-sample values

			Turn of assets 2011	Material costs per employee 2011
Spearman's rho	Turn of assets 2011	Correlation Coefficient	1,000	.477**
		Sig. (2-tailed)	.	.000
		N	52	52
	Material costs per employee 2011	Correlation Coefficient		1,000
		Sig. (2-tailed)		.
		N		52

Source: Empirical research results

The same conclusion applies to the mutual relationship of different financial performance (profitability) indicators, which proved to have a very strong correlation, also significant at 1% level, as demonstrated by Table 5.

Table 5. Financial KPIs correlations

			ROA 2011	ROE 2011	ROS 2011
Spearman's rho	ROA 2011	Correlation Coefficient	1,000	.999**	.999**
		Sig. (2-tailed)	.	.000	.000
		N	52	52	52
	ROE 2011	Correlation Coefficient		1,000	.998**
		Sig. (2-tailed)		.	.000
		N		52	52
	ROS 2011	Correlation Coefficient			1,000
		Sig. (2-tailed)			.
		N			52

** Correlation is significant at the 0.01 level (2-tailed).

Source: Empirical research results

Previous results indicate that **ERP users are also demonstrating a high level of association between different measures of financial performance**, which implies that the choice of relevant performance indicators should not influence the results of the analysis.

Nevertheless, there is **no statistically significant association between the dimensions themselves** (see results in Table 6), which leads to the conclusion that **Hypothesis 1 should be rejected**.

Table 6. KPIs correlations

			Turn of assets 2011	Material costs per employee 2011
Spearman's rho	ROA 2011	Correlation Coefficient	.089	-.151
		Sig. (2-tailed)	.529	.284
		N	52	52
	ROE 2011	Correlation Coefficient	.090	-.148
		Sig. (2-tailed)	.526	.297
		N	52	52
	ROS 2011	Correlation Coefficient	.080	-.160
		Sig. (2-tailed)	.573	.257
		N	52	52

Source: Empirical research results

In order to test the Hypothesis 2, the nonparametric version of the analysis of variance (ANOVA) will be used, which does not require the variables to be normally distributed.

This is the SPSS-based K-independent samples tests, which is used to test the differences of logistics and financial performance among users of three major ERP packages.

Mean values of logistics and financial performance for different groups of Croatian companies – ERP users are presented in Table 7.

Table 7. KPIs correlations

	ERP vendor	N	Mean Rank
Inventory turns	1	34	29.26
	2	7	21.86
	3	11	20.91
	Total	52	
Material costs per employee 2011	1	34	30.74
	2	7	14.00
	3	11	21.36
	Total	52	
ROA 2011	1	34	24.94
	2	7	30.21
	3	11	28.95
	Total	52	
ROE 2011	1	34	24.94
	2	7	30.21
	3	11	28.95
	Total	52	
ROS 2011	1	34	24.94
	2	7	30.64
	3	11	28.68
	Total	52	

Source: Empirical research results

The absence of statistical differences (demonstrated by Table 8) among the ERP users, grouped by ERP vendor, **shows that none of the vendors can claim that the usage of its software package is associated with superior performance in regard to profitability.** Only the amount of **production costs per employee significantly differs** across users of the three major ERP vendors. Nevertheless, this finding does not provide enough evidence that the specific characteristics of the ERP software used can be linked to the performance effects, which leads to the conclusion that **Hypothesis 2 should be accepted.** This finding is in line with the previous findings on ERP software packages becoming more of a “competitive requirement“ than a true source of competitive advantage, since many companies are implementing these complex software systems and their functionalities become a standard requirement for “normal“ competition in developed industrial and service environments.

Table 8. KPIs correlations^{a,b}

	Inventory turn 2011	Material costs per employee 2011	ROA 2011	ROE 2011	ROS 2011
Chi-Square	3.286	8,681	1.961	1.961	2.038
df	2	2	2	2	2
Asymp. Sig.	.193	.013	.375	.375	.361

a. Kruskal Wallis Test

b. Grouping Variable: ERP vendor

Source: Empirical research results

6. CONCLUSION AND FURTHER RESEARCH TASKS

The empirical results have not indicated the existence of patterns referring to the relationship between the logistics/supply chain and financial KPIs in the population of Croatian ERP users, which might have been expected (and has been previously empirically analyzed in a different context by Wieder et al., op. cit.). **Such an absence of cumulative results might be the result of a range of different factors, which should be addressed by future research.** Firstly, the Croatian economy is rather small and has been suffering from the effects of economic crisis, which could have created different distortions of the “regular” economic environment. In addition, it could be hypothesized that a significant motivation for the introduction of ERP packages in a small peripheral economy, with a high percentage of foreign corporate ownership, might be related to the owners’ intentions for removing managerial discretion in decision-making. This hypothesis has not been covered by previous theoretical analysis and/or empirical studies, but it could explain some specific features of complex IT projects in the Croatian economy and should be further investigated by future studies. **It has been also shown that the choice of an ERP vendor does not significantly influence the value of achieved performance,** which could be explained by a rather high level of sophistication of the analyzed three major ERP packages. In the future studies, it would be interesting to cover the customized ERP modules of different origin and other “alternative” ERP configurations.

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**POVEZANOST IZMEĐU LOGISTIČKIH I FINANCIJSKIH PERFORMANSI:
SLUČAJ HRVATSKIH KORISNIKA ENTERPRISE RESOURCE PLANNING
SUSTAVA**

Sažetak

U doba globalnog poslovanja, nabavni lanci postaju sveprisutni i kritični elementi poslovnih rezultata, s obzirom da suvremene organizacije pokušavaju unaprijediti performanse svoje logistike. Ova se optimizacija često pokušava postići korištenjem modularnih ERP sustava, koji predstavljaju obećavajući alat za postizanje superiornih rezultata u području logistike (i drugih poslovnih funkcija), kao i na razini poduzeća kao cjeline. Cilj ovog rada je utvrditi postoji li kumulativni efekt unapređenja rezultata poslovanja, koji "teče" od specifičnog funkcionalnog područja logistike (mjerenim odgovarajućim pokazateljima) prema korporacijskoj razini (a što se mjeri pokazateljima korporacijske profitabilnosti – povratom na aktivu, vlasnički kapital i prodaju). Nadalje, testira se utječe li izbor ERP dobavljača na postizanje poslovnih rezultata u analiziranom uzorku. Analiza je provedena na indikativnom uzorku 52 hrvatska poduzeća – korisnika najpopularnijih ERP sustava.