Supply chain integration and performance: Evidence from Romania

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ABSTRACT

The present paper investigates the link between supply chain integration and firm performance in Romania. The logistic regression results indicate that industry efficiencies determine company performance and that firms that are in industry segments with high operational efficiency are more likely to achieve top performance, regardless of supply chain integration or product type. Ownership of activities across the supply chain may lead to limited flexibility and does not necessarily translate in higher performance. For companies considering operations in Romania, industry and sub-industry analysis is critical, as success and growth may be predicated upon the industry operating margin.

Keywords: Supply chain integration, Performance, Romania.

JEL Classification: L10

Introduction

A supply chain is "the integration of key business processes from end users through original suppliers that provides products, services, and information that adds value for customers and other stakeholders" (Lambert et al., 1998). Successful supply chain management plays a critical role in how organizations

gain and sustain competitive advantage. In recent years, the concept has developed from a traditional emphasis on purchasing and logistics to a focus on value creation, which places integration at the center of supply chain management (Zailani and Rajagopal, 2005). Researchers have suggested that integration leads to increased performance. For example, Fröhlich and Westbrook (2001) linked supply chain integration to performance improvements. Lummus et al. (2008) found that firms with better integration of their supply chains perform better on a variety of metrics.

The present study investigates the relationship between supply chain integration and overall firm performance in Romania. The findings suggest actionable items to local managers and provide incentives for corporate executives to dedicate more resources to the management of supply chains. The research explores the applicability of supply chain concepts in similar countries that only recently completed the transition from centrally-planned to market economy and suggests valuable avenues for future research.

Very few studies address supply chain management issues in Romania. Wright (2013) finds that large manufacturers with innovative products are likely to adopt a responsive supply chain. Glaser-Segura et al., (2006) state that implementation of effective supply chain management in Romania is constrained by underdeveloped technologies and skills.

The paper starts with a review of literature on the relationship between supply chain integration and performance, including various aspects of integration and ways to evaluate performance. The review covers evidence from different industries and locations. The research question section is followed by a description of the data, sources and validity. The logistic regression methodology and results include explanations for the findings on the relationship between supply chain integration and probability of high performance for Romanian manufacturers. Additional insights for managers complete the interpretation. The paper ends with a discussion of limitations and conclusions.

Literature Review

Supply chain management has been defined as "the design and management of seamless, value-added process across organizational boundaries to meet the real needs of the end customer" (Fawcett et al., 2007). The objective of supply chain management is to "maximize value in the supply chain" and to allow a company to compete via improved efficiency and market effectiveness (Ambe, 2010).

Literature such as Pagell (2004) noted that "the entire concept of supply chain management is really predicated on integration". Madhani (2012) provided

empirical validation of the relationship between vertical integration and the overall performance of the organization. Frohlich and Westbrook (2001) found that the widest degree of arc integration (defined as extent of integration) with suppliers and customers has "the strongest association with performance improvement". Their research considered a variety of integrative activities (such as common logistical equipment and third-party logistics) and a number of performance indicators (including market share, profitability, productivity, customer satisfaction) for a global sample of manufacturers. A more recent paper (Forbes and Lederman, 2010) used more narrowly-defined operational performance measures and found a relationship with vertical integration for the US airline industry. Zailani and Rajagopal (2005) created a comparative study between US and East Asian companies and discovered that higher degrees of vertical integration were strongly associated with higher level of performance (defined as a combination of productivity growth, quality and delivery).

Kim (2006) explored the connections among supply chain management practice, competition capability, level of supply chain integration and firm performance and drew attention to the benefits of integration, especially for small firms, where efficient supply chain integration "may play a more critical role for sustainable performance improvement". Mpoyi and Bullington (2004) noted that the decision to integrate vertically leads to reduced production costs but not inventory costs.

Liu et al., (2013) provided empirical evidence for "the moderating effects of market orientation" on the relationship between supply chain integration and firm performance for manufacturing and service companies in China. A close look at the link between firm performance of pork processors in China and supply chain integration with upstream suppliers and downstream customers revealed that "internal integration and buyer-supplier relationship coordination are significantly related to firm performance in both relationships" (Han, 2013).

A recent literature review paper (Fabbe-Costes and Jahre, 2008) found that more supply chain integration does not always improve performance, and that more research and improved methodologies are needed. The paper synthesized findings across many studies on the relationship between integration and performance and acknowledged a variety of performance measures (net profit margins, return on assets, returns on investment, overall competitive position, general profitability and a mix of financial and operational measures, such as marketing and logistics performance). Supply chain integration was evaluated based on levels or layers of integration as flows, processes and activities, technologies and systems, or actors (structure and organizations).

In exploring the connection between integration and performance for manufacturers in Romania, the present study uses variables that are supported by the existing literature. The dependent variable is an overall company performance measure that encompasses both financial and non-financial aspects in line with the approach by Hansen and Wernerfelt (1989) and as acknowledged by Frohlich and Westbrook (2001). Supply chain integration is defined as upstream and downstream integration of processes and activities via ownership according to one of the approaches described by Fabbe-Costes and Jahre (2008).

One of the predictors in the current study is product type as innovative or functional, based on the product life cycle, product variety, contribution margin and lead time. In a paper examining the effects of integration on performance, Childerhouse and Towill (2011) found that product life cycle and lead times are statistically significant determinants of performance. They also discussed the number of product variants in the context of customization and competitive effects on performance. Martin and Patterson (2009) addressed inventory and cycle time in their exploration of the connection between supply chain integration and performance. They recognized that common performance measurements may not control for extraneous effects from other factors, which supports the use of a more complex performance assessment in the present paper.

Yang (2012) attempted to create a structural model of supply chain performance in an emerging economy and took "a firm's cost and innovation orientations into consideration since the orientations are critical to the knowledge strategies in achieving high supply chain capabilities". Chen et al. (2009) presented a conceptual model that relates strategic priorities, processes integration, efficiency and innovative capabilities to performance. They acknowledged a positive relationship between a firm's innovativeness and its performance. Ndregjoni and Elmazi (2012) also included product innovation (with a broad definition that fits the present study's classification of innovative products) in their predictors of firm performance in Albania.

Hsu et al. (2009) found support for the fact that supply chain management practices (i.e., integration) mediate the relationship between operations capability (such as new product design and development, total quality management and just-in-time competencies) and firm performance. Ju et al. (2013) explored performance implications of firm capabilities in China. Their model controlled for industry sales growth rate at the three-digit industry level and included production capability as a predictor variable. Their choice of variables is similar to the approach in the present study, in that they recognize the importance of production decisions and industry performance for overall firm success.

Innovation and industry, as well as effectiveness and cost aspects were included in a study of Spanish firms' performance by Pertusa-Ortega et al., (2009). Using industry as a control variable is common practice in studies of firm performance (e.g., Ju et al., 2013; Liu et al., 2012). Childerhouse and Towill, (2011) included it in their exploration on the effects of integration on performance. In a paper relating organizational slack and firm performance, Wefald et al. (2010) used broad industry groups and groupings that shared similar structural factors impacting competitive position, such as levels of capital or management of supply chain partners (these groupings were thought to replicate industry-based competitive conditions). Their findings support the relevance of industry for overall company performance and their approach is comparable to the method used in this paper.

As mentioned in the introduction, supply chain management studies in Romania are few. A recent study (Wright, 2013) pointed to the fact that the match between supply chain strategy (responsive or efficient) and product type (innovative or functional) is extraneous. Glaser-Segura et al., (2006) identified constraints and challenges of supply chain management that impact company performance. The research below looks for evidence that relates vertical integration to performance and adds to the knowledge on the role that supply chain decisions play for a firm's success.

Research Question

The present paper considers if firm boundary decisions affect firm performance, in the context of manufacturing companies in Romania. The analysis aims to determine if vertical integration increases the probability that a company will be highly ranked on performance. The methodology is logistic regression. The study uses a secondary sourced scoring and ranking methodology to assess performance. In addition to integration, two predictors are included in a similar manner to research reviewed above: product type (functional or innovative) and average operational efficiency in the industry segment. Industry is also introduced as a control variable. The sources and operationalization of variables are described in the section below.

Validity, Data and Sources

To ensure internal validity, the research builds on explanations drawn from supply chain management theory and existent literature, and addresses rival explanations for the results. The study concludes on the value of findings for practitioners and researchers and confirms that the findings are generalizable for external validity.

The study uses a sample of Romanian manufacturers in various industries. Data were collected from two sources. Information on company and industry performance was collected from the 2012 "Major Companies in Romania" report, developed and published by doingbusiness.ro and Ernst & Young (Ernst & Young and doingbusiness.ro, 2012). Doingbusiness.ro is a collection of Romanian news from various sources and of companies' profiles and information from the Kompass Romania business-to-business database. Data on supply chain integration and product type were collected directly from the Kompass Romania database, a subset of the worldwide Kompass company, which is a compiler of business information about companies in over 70 countries. The database is used by practitioners for creating targeted lists of potential customers and suppliers and for evaluating competitors and supply chain partners. The database can be used extensively for research requiring company data and is one of the most comprehensive sources of information on companies in Romania.

The doingbusiness.ro company database integrates information from Kompass Romania with information available for companies listed on the Bucharest Stock Exchange, information from publicly-available company documents and national press articles. While this database was the starting point for collecting product type data, follow-up information on this aspect was also collected from publicly available sources (such as documents available on a company's website, press releases and information from the national media, such as Ziarul Financiar, accessible at http://www.zfenglish.com/).

Performance is determined by placing each company in one of two categories. The first category is comprised by companies that were ranked in the top 300 in the "Major Companies in Romania" report. The second category includes companies that are a representative sample (with industry representation similar to the companies in the first category), but that were not ranked as top performers. In the "Major Companies in Romania" report, Ernst & Young and doingbusiness.ro developed a company ranking methodology based on a scoring system by which each company was assessed on a variety of factors (Ernst & Young, 2012). The methodology is one of the most comprehensive assessments of performance and accounts for financial and non-financial performance at the company level. The indicators included in the ranking score for each company are: revenue, average number of employees, type of company (listed, unlisted), "corporate social responsibility and environmental initiatives developed in Romania", value of local brand, EBITDA (earnings before interest, taxes, amortization and depreciation) growth, current ratio, return on equity ratio, debt to equity ratio and interest coverage ratio. Higher scores represent higher

performance. The ranking includes companies that have filed financial statements for the year 2011 with the Romanian Trade Register.

Supply chain integration is established based on the company profile in the Kompass database, describing object of activity and products and services according to a detailed industry classification (based on industry codes- "Clasificarea activitatilor din economia nationala" CAEN- in Romania). Companies (with manufacturing as the main object of activity) that fully integrated or integrated across at least two stages of the supply chain (downstream or upstream) were considered to have an integrated supply chain. These manufacturers are also wholesalers or retailers, act as suppliers, etc. Vertical integration was thus considered as processes and activities, via ownership.

Industry is categorized according to the "Major Companies in Romania" report: chemicals, pharmaceuticals, glass and ceramics, metal, machinery, electric and electronic equipment, information technology and computers, constructions, fast moving consumer goods, automotive and wood, paper and furniture.

For each company, the product type is classified according to Fisher's framework (Fisher, 1997) and replicated from a recent study that investigated how this model can be applied in Romania (Wright, 2013). For this purpose, the product life cycle, product variety, contribution margin and lead time were investigated separately for each company. The Kompass database provides specific descriptions of products and product lines and some information related to contribution margins and lead times. Additional information was collected from company's documents available online, press releases and news. A company's product type was defined as functional if the main product (often product line or product family) appealed to basic needs and was readily available, while also satisfying the following conditions simultaneously: a product life cycle longer than 2 years (based on descriptions provided in the doingbusiness.ro and Kompass databases), fewer than 20 variants in the product line or family (according to the classification and products listing in the databases), contribution margins under 20% (according to financial information provided in the databases or the company's documents), and lead time longer than 6 months (as implied in the Kompass database, press releases or news articles). A company's product type was classified as innovative if the product had a life cycle of up to a year, more than 30 variants, contributions margins higher than 20%, and lead times measured in weeks. Companies with more than 3 distinct product lines or that had both functional and innovative product lines were not included in the study. Although companies are classified by the industries identified above, the product type for each company in the same

industry varies. For example, in the automotive industry, parts producers vary in product type based on their specialization, type of clients, technology used, etc.

The "Major Companies in Romania" report presents financial and non-financial data for representative companies in separate industry segments within every industry (for example, the chemicals industry includes manufacture of rubber and plastic products and manufacture of paints, varnishes and similar coatings, printing inks and mastics). Average return on sales of representative companies in the industry segment is used in this study to measure the average operational efficiency. This ratio evaluates the operating profit margin in the sub-industry (industry segment). The industry is used as a separate variable. The sub-industries in a particular industry vary widely in terms of operational efficiency.

Although only secondary data were used, the construct validity of this study is ensured by the development of a sufficiently operational set of measures that are consistent with extant literature. The evaluation of information was systematic and consistent, and the data were verified across sources. The cases for which some of the data could not be evaluated and the cases for which data led to inconclusive classifications were eliminated.

Methodology and Results

Data are compiled for a total of 202 companies in Romania. The statistical methodology used to investigate the research question is logistic regression. This technique has no assumptions about the distributions of the predictor variables, which do not have to be normally distributed, linearly related or of equal variance. Maalouf (2011) promotes the usefulness of logistic regression for binary data classification, especially in circumstances that describe "rare events" or "imbalanced" data. Particularly useful for the present analysis is the fact that logistic regression predictors can be any mix of continuous, discrete and dichotomous variables. According to Meyers *et al.* (2006), the dichotomous variables "need not be truly binary; [..] researchers may transform a highly skewed quantitative dependent variable", which supports the operationalization of the performance variable in this study. In line with recommendations from the same authors, the industry and product type variables are used to statistically control for certain effects and better assess the unique effects of predictors.

In general, the estimates in logistic regression provide the S-shaped logistic function that relates predictors to probabilities of certain events. The estimated coefficients for continuous, discrete and dichotomous variables are therefore expected to be numerical. The technique emphasizes the probability of a particular outcome for each case. In this instance, it evaluates the probability that

a company is ranked as a top performer. The scope is to determine if vertical integration increases the probability of top performance, with additional independent variables that account for product type (functional or innovative), industry and operational efficiency in the industry segment. The variables are described in detail in the previous section. The representation in the sample according to the variables included in the statistical model is presented in **Table 1**.

Table 1
Descriptive Statistics and Data Frequencies by Variable

Variable	Mean/median	Values	Frequency	Percent
PERF	Median=0.00	0	102	50.50
		1	100	49.50
INTEGR	Median=0.00	0	148	73.30
		1	54	26.7
IND	Median=7.00	1	19	9.40
		2	8	4.00
		3	10	5.00
		4	28	13.90
		5	17	8.40
		6	14	6.90
		7	10	5.00
		8	5	2.50
		9	52	25.70
		10	29	14.40
		11	10	5.00
PROD	Median=1.00	1	175	86.60
		2	27	13.40
INDROS	Mean=0.89; Median=2.23			

Source: Author's own. Total number of firms included in the study is 202.

The model used for statistical analysis is formulated as follows:

$$E(y) = \exp(u)/(1+\exp(u))$$

$$where \quad y = PERF$$

$$and \quad u = \beta_o + \beta_1 INTEGR + \beta_2 IND + \beta_3 PROD + \beta_4 INDROS$$

The probability of top performance can be calculated as:

$$p(PERF) = \frac{e^{\beta_o + \beta_1 INTEGR + \beta_2 IND + \beta_3 PROD + \beta_4 INDROS}}{1 + e^{\beta_o + \beta_1 INTEGR + \beta_2 IND + \beta_3 PROD + \beta_4 INDROS}}$$

Where:

PERF represents performance category (1-top performer, 0-low performer) and differentiates companies according to performance rankings based on scores presented in the "Major Companies in Romania" 2012 report by Ernst & Young and doingbusiness.ro. Top performers are identified as the best performing 100 manufacturers; low performers are 102 manufacturers from the same industries and industry segments that rank low in the report.

INTEGR refers to supply chain integration (1-integrated supply chain, 0-not integrated supply chain) and distinguishes between vertically integrated companies at minimum two stages of the supply chain (downstream or upstream) and non-integrated companies that operate only as manufacturers.

IND controls for industry (1-chemicals, 2-pharmaceuticals, 3-glass and ceramics, 4-metal, 5-machinery, 6-electric and electronic equipment, 7-constructions, 8-information technology and computers, 9-fast moving consumer goods, 10-automotive, 11-wood, paper and furniture).

PROD classifies product type (1-functional product, 2-innovative product), where a functional product satisfies basic needs and is readily available, has a product life cycle longer than 2 years, low product variety (fewer than 20 variants), low contribution margin (under 20%) and a lead time that is longer than 6 months. In contrast, the innovative product category is based on a product life cycle of up to a year, high product variety (more than 30 variants), high contribution margin (over 20%) and low lead time measured in weeks.

INDROS is average return on sales of representative companies in the industry segment; calculated as average profit or loss divided by annual sales (both in local currency- RON) for representative companies corresponding to industry segments (sub-industries within the main industry categories recognized in the IND variable).

The results of the logistic regression find no inordinately large parameter estimates or standard errors, which means that there is no reason to suspect a problem with outcome groups being perfectly predicted by any variable. There is also no indication of violation of the linearity in the logit for the model proposed.

The results show no problem with convergence. No multicollinearity is evident. There are no outliers.

A model that includes the industry (IND) variable and a model without this variable are compared. A constant-only model is used as a baseline. The logistic regression outcomes are presented in **Table 2** below.

Table 2 a. Summary of Results for Logistic Regression Analysis

Model	Omnibus Tests of Model Coefficients[*]		Hosmer and Lemeshow Test		Strength of Association		Classification	
	Chi-square	Sig.	Chi-square	Sig.	Cox and Snell R-Square	Nagelkerke R-Square	Overall Percentage	Cut Value
Model Including the Industry as a Control Variable	12.18	0.01	8.78	0.36	0.06	0.08	56.90	0.50
Model Not Including the Industry as a Control Variable	9.30	0.02	9.6	0.29	0.05	0.06	59.40	0.50

[*] indicates improvement over the constant-only model

As indicated in **Table 2.a,** the comparison of the constant-only model with the full model including all variables shows a sufficiently significant probability value for the full model with a Chi-square of 12.18 and an adequately low p value of 0.01. Chi-square also shows comparative goodness-of-fit for the model with the industry control variable and the model without it. The model including the industry variable is more statically reliable than the model without this variable**.** Chi-square for the model without the industry variable is 9.30 with a p-value of 0.02, demonstrating that the model fit decreases when the industry predictor is removed. This conclusion is also supported by the slight decrease in the strength of association measures when industry is not included (Cox and Snell R-Square equal to 0.05 as compared to 0.06 for the full model and Nagelkerke R-Square of 0.06 from 0.08 for the full model). These measures are considered to be absolute measures of the validity of models (Meyer *et al.*, 2006).

Table 2 b. Summary of Logistic Regression Analysis for Variables Predicting Performance

Model Including the Industry as a Control Variable				
Variables in the Equation	Coefficient	Wald	Sig.	Exp(B)
INTEGR	0.33	0.98	0.32	1.39
PROD	-0.76	3.07	0.08	0.47
INDROS	0.08^{t}	6.15	0.01	1.09
IND	0.08	2.77	0.96	1.08
Constant	0.17	0.09	0.77	1.19
Model Not Including the Industry as a Control Variable				
Variables in the Equation	Coefficient	Wald	Sig.	Exp(B)
INTEGR	0.35	1.15	0.28	1.42
PROD	-0.70	2.68	0.10	0.49
INDROS	0.08^{t}	6.08	0.01	1.09
Constant	0.60	1.38	0.24	1.83
Model With Constant Only				
Variables in the Equation	Coefficient	Wald	Sig.	Exp(B)
Constant	-0.02	0.02	0.89	0.98

Source: Author's own. ^{t} $p<0.10$

The comparative results of alternative models (**Table 2.b**) show that the model with the constant only has no prediction value, with a high p-value of the Wald test (almost 89%), which supports the validity of the models that include the predictive variables. We can conclude that the predictors, as a set, reliably predict the level of performance. Since the more complete model (the model with all variables, including industry) is more robust, the ensuing interpretation of results is focused on this model. Prediction by the model that includes all variables is relatively good, with an overall success rate of almost 57 percent (the model classifies correctly 57% of the companies included in the study). The measures of association are low: more specifically, Nagelkerke R- Square and Cox and Snell R-Square tests of model validity indicate that a low percentage of variance (approximately 8% and 6%, respectively) in the performance is explained by the independent variables. Nevertheless, these pseudo-R-Squared estimates cannot reach high values by design (Meyer *et al.*, 2006). Tabachnick and Fidell (2007) suggest that, for large samples, a statistical difference between

a fitted model and the observed frequencies may not indicate a poor model. The analyst should keep in mind both the effects of sample size and the way the test works. Another typical overall test, the Hosmer and Lemeshow test, has a non-significant Chi-square (8.78 with p=0.36), which indicates that the predicted probabilities match the expected probabilities.

The estimated coefficients provide the nonlinear logistic function of the best combination of predictors, and, therefore, the values are appropriate (as presented in **Table 2.b**). However, the significance of each coefficient varies. A typical criterion in logistic prediction, the Wald test (Tabachnick and Fidell, 2007), is used to investigate if each variable significantly predicts response category. According to the Wald criterion, only average operational efficiency in the sub-industry (average return on sales in the industry segment, INDROS) reliably predicts performance (p<0.10). There is an increase in the likelihood that a company is a top performer if it operates in an industry segment with high efficiency. Specifically, 1% increase in the operational efficiency in the industry segment doubles the odds of high performance (Exp(B)=1.088). Operating in a higher efficiency sector leads to better overall performance, irrespective of vertical integration, product type or industry. The same criterion shows that performance groups are not distinguished on the basis of vertical integration. The results thus find no support for a predictive connection between integration and performance. Type of industry is not significant. Companies with innovative products are not more likely to be successful.

We can conclude from the statistical analysis that company performance depends on industry segment performance alone. Companies that are in industry segments with high efficiency are more likely to perform well, regardless of their product type or supply chain integration. Thus, supply chain integration does not increase the probability of high performance for Romanian manufacturers.

An explanation for the apparent lack of causal relationship between supply chain integration and performance may be that integration need not be via ownership. It is conceivable that manufacturers may achieve high levels of integration through good coordination with supply chain partners. Frohlich and Westbrook (2001) found no proof of the causal relationship between integration and performance, but provided evidence that coordination in the supply chain differentiates performance. In the context of analyzing the relationship among supply chain integration, market orientation, and firm performance, Liu *et al.*, (2013) found that operational coordination is positively related to company performance in China. They conceptualized integration as coordination. The difference in how the integration was conceptualized explains the apparent dissimilarity in results but also provides a possible explanation for the current findings.

Lafontaine and Slade (2007) concluded that firms with market power are able to be competitive "with various forms of vertical restraints rather than integration. [..] There would be no way to identify the consequences of vertical integration if nonintegrated firms could achieve similar results with contractual restraints." This suggests that companies in industry segments with high operating margins may enjoy the benefits of partnerships, alliances or other forms of effective relationships with suppliers and distributors. The explanation is encouraging for the development of strong industries in Romania, where companies may have reliable and successful networks and contractual connections. These industries can be attractive to domestic and foreign entrants in terms of existing supply chain partners. This reasoning also cautions entrants of the market power of existing companies with established relationships in the supply chain.

Ciliberto and Panzar (2011) suggested that vertically integrated firms can exploit economies of vertical scope in the fixed costs, but they face "rivalries (rather than complementarities) in the marginal costs". "Economies of vertical scope in the fixed costs are likely to exist when firms are still learning how to produce final goods and how to design the best intermediate inputs for the final goods. Firms can then benefit from producing both at the same time. As time goes on, the process of learning by doing will standardize the production processes, and economies of scope will slowly disappear." This may be a valid explanation for the results that is rooted in the experience and learning effects of manufacturing companies in Romania. The findings would suggest that vertical economies of scope are not a differentiator in performance, given that certain industries are no longer at the emerging stage. This would also explain the finding that a company's success depends predominantly on the industry segment's operational efficiency, rather than on vertical integration decisions.

Fabbe-Costes and Jahre (2008) proposed that the common assumption that integration always improves performance should be questioned by researchers and avoided by practitioners. These authors suggested that tight integration may lead to limited flexibility, an explanation that is plausible in a dynamic market such as Romania, which went through a long period of transition from a centralized system and is still modernizing institutions.

Zailani and Rajagopal (2005) recognized the importance of the "interrelationships among different parts of the supply chain" and suggested that performance improvements occur when "proper alignment is ensured between the design and execution of the company's competitive strategy". Their article emphasized the need for aligning the manufacturing strategy across the supply chain in order to create competitive advantage. The authors pointed to the fact that supply chain integration strategy should be linked to the corporate

diversification strategy. This opens up a prospect that may be concerning to manufacturers in Romania. Companies with integrated supply chains via ownership should benefit from sustainable competitive advantage. However, this study finds that performance is related to the operating margin in the industry segment, and not to vertical integration. Manufacturers are not creating competitive advantage via supply chain management but they rather take advantage of external efficiencies in their sectors. Should such efficiencies be lowered by external factors (regulation, slowdown in demand, etc.) companies will face a decrease in performance. This alternative interpretation would need to be explored further in future research.

This study on the causal relationship between supply chain integration and performance concludes that more integration does not always improve performance. Researchers and practitioners are cautioned not to assume such a relationship. While studies, including many of the ones in the literature review, covered the connection between integration and performance in different industries, time periods, and geographic regions, none addressed the relationship in Romania. The evidence at this location may leave much to be learned about theories and best practices.

Overall Interpretations and Additional Insights for Managers

The results of the study can be used to provide prescriptive insights for managers. They indicate that companies operating in industries with high operating margins have a larger probability to be high performers in Romania.

The results prove that it is valuable for companies to enter and develop competencies in industries with high operational efficiency. Understanding local industry segments and how lucrative they are is thus paramount in the analysis of the Romanian business environment. Such an analysis is key for companies that are about to enter Romania with manufacturing operations. For companies that are already in Romania, the findings suggest benefits from expanding into sub-industries with high efficiencies. The results provide reasons for companies to build systems that would protect them when industry circumstances change. The results hold value for country policy makers who aim to develop and support industries that are important for the country's economic development. The findings may also be used to promote foreign investments in certain industry segments.

Ownership of supply chain stages is not a pre-requisite for high company performance. Manufacturers in Romania may run effective operations via contractual relationships with suppliers and distributors. The take-away for practitioners is that vertical integration may decrease flexibility and may not

always lead to increased performance. Miocevic and Dedic (2012) discussed the value of flexibility in building capabilities that relate to the management of the supply chain so that "chain members share common values and beliefs that are focused on viewing the supply chain as an integrated business system". Their research used evidence for Croatian manufacturers, which may prove the wide applicability of these results.

Although the knowledge is acquired in the Romanian context, it is possible that the findings of this study expand to other Central and Eastern European countries. Many companies here face similar challenges, such as underdeveloped infrastructure and variations in supply availability. Bachev (2011) acknowledged the similarities across the region triggered by the liberalization of markets, modernization of supply chains and institutional changes and argued for common findings on supply chain management in these environments. The evidence in this research contributes to the understanding of supply chain management best practices in the region.

Limitations and Final Conclusions

Future research would benefit from investigating further the findings and explanations proposed in this paper. Case studies and surveys may be appropriate for exploring how successful manufacturers in Romania approach their supply chain decisions. The method of this study focuses on operations tactics and industry as determinants of performance. Other functions (e.g., human resources) and other external aspects (e.g., regulation) may also affect performance. The fit of the model and statistical significance of the results are acceptable, but not very strong. This may indicate that a more complete model exists. The strength of the analysis also depends on the secondary data quality and implicitly on the interpretations that were made to classify the nominal variables.

While the performance measure in this study is robust in that it accounts for financial and non-financial aspects, it may diffuse the interpretation of results. For example, size is a factor included in the evaluation of performance. This may mean that large companies may be "destined" to perform better. Although one of the variables (INDROS) is found to have impact on performance, the set probability of making a Type I error is not very low (according to the level of significance in the Wald test of 10%). Nevertheless, as explained above, the prediction can be considered appropriate for the model.

There are very few studies on operations strategy and performance that take place specifically in Romania. This location makes for valuable insights, as the

country emerged recently from the transition from a centrally planned economy and is now integrated in the European Union. The present study makes an important contribution to the literature on performance, strategy and operations management, by analyzing the relationship between vertical integration and performance in Romania. Previous research showed no conclusive findings that such a relationship exists. The current paper adds to the evidence. The results suggest that manufacturers need supply chain coordination processes and systems that protect them when industry conditions evolve.

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