

# **The Impact of Risks in Supply Chain on Organizational Performances: Evidence from Romania**

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## **ABSTRACT**

*The proposed empirical research uses a national sample of 64 Romanian companies from various industries to document the relationship between organizational performances and risks in the context of Romanian supply chains. Empirical findings show that a supply chain risk management strategy successfully mitigates the negative consequences of risks. Our research underlines the changes necessary to maximize the benefits of supply chain integration. To extend the knowledge in this area our research is interdisciplinary, using a structural approach to model the determinants of organizational performances in supply chains and to measure the complex relationships among risks in supply chains and different facets of organizational performances in the context of Romanian supply chains.*

**KEYWORDS:** *supply chain risks management, organizational performances, structural equations*

**JEL CLASSIFICATION:** *C35, C54, M10.*

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## **INTRODUCTION**

A supply chain encompasses the organizations, activities and processes associated with the flows of products, services, information and capital, from their origin to the ultimate consumer (Butilca, et al., 2011). According to the Council of Supply Chain Management Professionals, the management of a supply chain (SCM) refers to planning and management of all activities associated with procurement, production, distribution and coordination among supply chain members. The concepts of supply chain is not unanimously accepted. Butilca, et al. (2011) show that studies in the field of MSC employ 11 terms to underline different facets of the underlying concept. Nevertheless the concept of supply chain has resisted its critics and is currently preferred by most practitioners and researchers in the field.

Over time the SCM has suffered transformations concerning activities, processes and the actors involved. Kumar and Nambirajan (2013) show that focus shifted gradually from integration at organizational level to integration of activities and business process at the supply chain level. Supply chains maximize the benefits for all the participants through either a strategy of operational excellence or collaborative closeness (Stank, Keller and Closs, 2002). Lu (2011) shows that supply chain is by definition the extended enterprise where business engagement is based not only on cost-driven considerations but also on incentives, rewards, knowledge exchange and commitment.

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Existing national research in the field of SCM focuses on the relationship between organizational performances and performances in supply chains (Florian and Constangioara, 2013) or on the problematic of entrepreneurial supply chains (Antonicic and Scarlat, 2005; Antonicic and Prodan, 2008).

In what follows we focus on the problematic of supply chain risk management (SCRM), identifying the drivers of risks in the supply chain and the strategies to cope with them. Current knowledge in this area is fragmented and incomplete. In order to remedy this we approach the problematic of SCRM in the general framework provided by SCM. Our results provide management with the motivation to foster integration of key business process and to implement adequate strategies to cope with risks in supply chains.

## 1. SUPPLY CHAIN RISKS AND ORGANIZATIONAL PERFORMANCES

Sodhi, Son and Tang (2012) perform a throughout review of SCRM literature. They show that researchers in the field consider SCRM a subset of SCM, with additional focus on risks and strategies dealing with unknown, disruptions and supply-demand stochastic.

Sharma and Chrisman (1999) defined risks in supply chains as a "variation in the distribution of possible supply chain outcomes, their likelihood, and their subjective value." Accordingly, supply chain risks might result not only in negative outcomes but only on positive ones. This approach is rooted in the Markowitz portfolio selection theory and the subsequent approach to risks in financial research. Nevertheless, decision theory underlines the negative consequences of risks. This approach is also embraced by many researchers in the field of SCRM, who consider that risks in supply chains are associated with chance of danger, loss, damage or any other undesired consequence (Wagner and Bode, 2008). For the purpose of this paper we follow Wagner and Bode (2008) and consider that in the context of supply chains risk incur only negative consequences.

In what follows we provide a classification of supply chain risks, focusing on identifying categories of risks at different links of supply chains and their drivers. We also revise the SCRM literature in search of empirical evidence on the relationship between risks in supply chains and organizational performances.

Vikulov and Butrin (2014) propose a classification that allows identifying risks in specific links of supply chains. Risk categories are identified at major supply chain link and business process: (a) suppliers, (b) transport, (c) warehousing, (d) production and (e) marketing.

**Table 1. Supply chain risks**

<b>Risk category</b>	<b>Composition of risks</b>
Risks associated with suppliers	Delivery schedule
	Prices
	Non –delivery / Short-delivery
	Poor-quality
Risks associated with transport	Damage of goods in transit
	Loss of goods in transit
Risks associated with warehousing	Damage of good during storage
	Changes in taxes and other costs of warehousing

Risk category	Composition of risks
Risks associated with production	Quality problems
	Overproduction
	Disruptions due to equipment failure
	Disruptions due to procurement issues
Risks associated with marketing	Volatile demand
	Wrong promotion strategy
	Failure of networking sales

Source: Adaptation from Vikulov and Butrin, 2014, p. 45

As table 1 shows, business processes in supply chains do not limit themselves to logistics. Production, logistics and marketing are the functional domains with the highest incidence of risks in supply chains.

Wright and Datskovska (2012) depict the impact that changes in business environment have on operations and supply chains management. They show that while globalization might have increased the performances in supply chains through facilitating access to markets, resources and factors, many organizations are increasingly relying on outsourcing and offshoring which made local concentrated risks become globally diffused, involving multiple actors. Geographical concentration of production has increased the disruption impact of local events. Increasing the complexity of products and networks induced reliance on multiple parts and players which made quality monitoring more difficult. Single sourcing corroborated with the reduction of buffer stocks reduced the number of alternatives. Finally, increased information availability made operations increasingly reliant on information flows and volatile governmental legislation might impede the efficient flows within the supply chains.

Synthesizing, SCRM literature identifies risks drivers in the context of supply chains (table 2).

**Table 2. Risks drivers in supply chains**

Risk factor	Risks indicators
Demand side risks	Volatile demand
	Insufficient information from customers about orders
	Distorted information from customers about orders
Supply chain risks	Poor logistics performance of suppliers
	Supplier quality problems
	Unexpected default of a supplier
	Poor performance of logistics service providers
	Capacity fluctuation or supply shortages on the supply markets
Regulatory, legal or bureaucratic risks	Legislative/fiscal instability
	Administrative barriers for the setup or operation of supply chains
Infrastructural risks	Downtime or loss of own production capacity due to local disruptions (labor strikes, industrial accidents)
	Breakdown of internal IT infrastructure (viruses, software bugs)

<b>Risk factor</b>	<b>Risks indicators</b>
	Loss of own production capacity due to technical reasons (machine deterioration)
	Perturbation or breakdown of external IT infrastructure
Catastrophic risks	Wars, civil unrest or other socio-political crisis
	Diseases or other epidemics
	Natural disasters
	Terrorist attacks

*Source: Wagner and Bode, 2008, p. 323*

According to Wagner and Bode (2008), coping with supply chain risks necessitates adequate strategies. Indicators of supply chain risk management are:

- Collaboration with suppliers to develop transparent supply chains and an open sharing of information;
- Business continuity or contingency plans addressing several supply chain risks;
- Monitoring suppliers for possible supply chains risks;
- Product differentiation for reducing demand side risks;
- A distinct organizational structure dedicated to SCRM;
- Insurance against supply chain risks.

Insofar as the empirical evidence are concerned, Wager and Bode (2008) and Wagner and Neshat (2011) document the negative relationship between supply chain risks and organizational performances.

## **2. EMPIRICAL EXAMINATION OF ORGANIZATIONAL PERFORMANCES ALONG SEVERAL DIMENSIONS OF SUPPLY CHAIN RISKS**

Building upon existing literature in the field, present research investigate the impact of supply chain risks on organizational performances.

### **2.1. Conceptual framework**

Existing literature in the field shows that firms that are exposed to risks in supply chains can expect lower performances as compared to those who are exposed to lower levels of risks. Higher level of risks means more disruptions and negative consequences such as quality problems, customers' complaints, delays and mismatch of supply and demand. Following Wagner and Bode (2008), we measure risks drivers in the context of supply chains and formulate the first hypothesis of present research:

- Hypothesis 1: supply chain risks are negatively correlated with organizational performances;

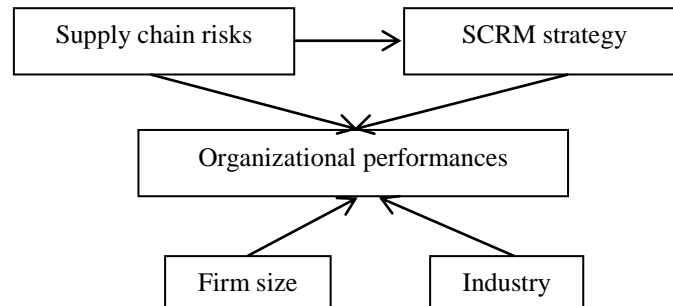
Firms can start reducing the negative effects of risks by placing priority on developing adequate SCRM strategies. Effective communication of organizational priorities and approach meant to cope with risks in the context of supply chains is paramount to organizational performances giving today's volatile business environment (Wagner and Bode, 2008). Thus our second hypothesis is:

- Hypothesis 2: SCRM strategies do have a positive impact on organizational performances.

Vij and Bedi (2012) documents the influence of moderators on organizational performances. This entitles us to formulate the third hypothesis of present research:

- Hypothesis 3: the relationship between supply chain risks and organizational performances stays robust even after controlling for firm size and industry.

For analyzing the SCRM–organizational performance relationship we propose the conceptual framework presented in figure 1.



**Figure 1 Conceptual framework**

According to figure 1, organizational performances are determined by the extent of risks in the context of a supply chain. The existence of adequate SCRM strategies mitigate the negative consequences of risks on organizational performances. In addition firms' size and industry also have a direct effect on organizational performances.

Our proposed conceptual framework incorporates the following constructs:

- Supply chain risks
- SCRM strategy
- Organizational performances

We have followed SCRM literature to identify the indicator variables corresponding to 'Supply chain risks' and 'Supply chain risks management strategy'. Indicator variables corresponding to 'Supply chain risks' are presented in table 4. Those corresponding to 'Supply chain risks management strategy' are depicted in table 5. Based on Richard, et al. (2009) and Ho, Au and Newton (2002) we use accounting indicators to quantify organizational performances. Indicator variables corresponding to 'organizational performances' are presented in table 6.

## 2.2 Methodology

We have conducted an extensive supply chain research targeting an initial sample of 200 Romanian companies. We collected data using a survey-based questionnaire asking the respondents to assess (a) different aspects of SCRM strategy in their firm, (b) the risks in supply chains and (c) different facets of organizational performances. Risks in supply chains were assessed using a five point measurement scale, ranging from 1=very low risks to 5= very high risks. Respondents were asked to identify the practices specific to SCRMS

and answers were codified by means of a dichotomous variable. Finally respondents were asked to assess different aspects of organizational performances in their firms as compared to those of the competitors. For measuring performances we also employed a five point scale (1=much worse than competitors, 5=much better than competitors). The questionnaires were filled at the local branch offices of Romanian companies during the autumn of 2013. In total we obtained 64 usable responses. Our response rate is 32%, similar to that reported by Wang and Yen (2012) (24.9%). Sample size is also similar to that employed by research in the field (Wagner and Bode, 2008). Analysis was conducted with statistical package SAS 9.3.

Following recommendation in SCM literature, we first analyzed the measurement scales used to assess supply chain risks, SCRMS and organizational performances. Subsequently we have used the structural equation modeling to test the hypotheses of the study. For the structural analysis we have used only the indicator variables with adequate factor loadings.

For the measurement model we have chosen a confirmatory analysis because in its case the existing statistical techniques are more efficient in evaluating the overall model fit (Dunn, Seaker and Waller, 1994). Our choice for structural equation modeling (SEM) was dictated by the fact that SEM is the most prevalent research methodology employed in supply chains research (Kumar and Nambirajan, 2013).

The analysis of frequencies of companies in the working dataset reveals that the proposed analysis uses a sample of firms from various industries, covering all levels of a supply chain, from production to commerce (table 3).

**Table 3. Frequencies by industry**

<b>Industry</b>	<b>Frequency</b>	<b>Percent</b>
Metallurgical	5	7.81
Electrical and electronics engineering	9	14.06
Chemicals	1	1.56
Furniture and wood	4	6.25
Constructions	9	14.06
Textiles	4	6.25
Food	7	10.94
Transport	5	7.81
Telecommunications	4	6.26
Commerce	8	12.50
Other	8	12.50

Table 3 reveals that only 16 firms in our sample are from commerce and other services.

### **2.3. Analysis of measurement scales**

A throughout review of existing literature has ensured the substantive validity of the scales, all the items being conceptually and theoretically linked to the construct. Unidimensionality of a scale is ‘the degree to which items load only on their respective constructs’ (Dunn, Seaker and Waller, 1994). Higher estimated factor loadings is evidence for unidimensionality. Reliability is the overall consistency of a scale measure. A measure of reliability is given by Cronbach’s  $\alpha$ .

Once a model is estimated it is necessary to evaluate the overall fit of the model. A comprehensive presentation of them is found in Yung (2010). Following similar research, in order to assess model fit we use four indices:

- goodness-of-fit (GFI)
- standardized root mean square residual (SRMR)
- root mean square approximation (RMSEA)
- comparative fit index (CFI)

Adequate fit is given by high values of GFI and CFI (>0.9) and low values for SRMR and RMSEA (<0.08).

Model fit statistics and the results for the analysis of unidimensionality and reliability of scales are presented in tables 4-6.

**Table 4. Standardized path results for supply chain risks**

Path		Estimate	Standard Error	t Value	Model fit	
risks	- - - >	Product characteristics	0.73	0.06	11.38	Cronbach Alpha=0.90 GFI =0.84 RMSEA=0.08 SRMSR=0.07 CFI=0.91
risks	- - - >	Processes/ Production	0.84	0.04	18.88	
risks	- - - >	Decisional complexity	0.76	0.06	12.84	
risks	- - - >	Organizational structure and human resources	0.65	0.08	8.21	
risks	- - - >	Final demand	0.78	0.08	8.56	
risks	- - - >	Suppliers	0.76	0.06	12.73	
risks	- - - >	Forecasting horizon	0.81	0.05	16.42	
risks	- - - >	Supply chain configuration, infrastructure and facilities	0.70	0.07	9.55	
risks	- - - >	External environment	0.82	0.10	5.54	

Path		Estimate	Standard Error	t Value	Model fit	
risks	- - - >	Natural disasters	0.10	0.13	0.79	

As table 4 shows, ‘supply chain risks’ is not a unidimensional latent variable. Factor loadings do not meet the threshold requirement for ‘natural disasters’. Also the loading for ‘organizational structure and human resources’ is relatively low. Except for the estimated coefficient corresponding to ‘natural disaster’ all estimates are statistically significant, exceeding the 1.96 value required for 5% statistical significance under de normality assumption. Values of Cronbach’s  $\alpha$  reported in table 4 support the reliability of all three constructs. Except for GFI which is slightly low, all fit indices are adequate.

Table 5 presents the results for the measurement model corresponding to SCRM strategies.

**Table 5. Standardized path results for SCRM strategy**

Path		Estimate	Standard Error	t Value	
strategy	--->	Contingency plans	0.66	0.10	6.40
strategy	--->	Suppliers selection and monitoring	0.35	0.13	2.67
strategy	--->	Avoiding procurement from risky zones	0.35	0.13	2.61
strategy	--->	Avoiding operations from risky zones	0.20	0.14	1.39
strategy	--->	Formal SCRM	0.29	0.14	2.12
strategy	--->	Support for suppliers	0.59	0.11	5.39
strategy	--->	Safety stocks	0.55	0.11	4.77
strategy	--->	Multiple sources from procurement	0.29	0.14	2.15
strategy	--->	Excess production capacity	0.58	0.11	5.26

Analysis of the measurement model corresponding to SCRM strategy reveals that the construct is not unidimensional. However the estimated loadings for ‘contingency plans’, ‘support for suppliers’, ‘safety stocks’ and ‘excess production capacity’ display a relatively strong association with the underlying latent variable. In addition they are all statistically significant. With all indicator variables included, model fit is not satisfactory. Consequently we drop all indicator variables with low factor loadings. The resulted model fit is satisfactory (GFI=0.99, RMSEA=0, SRMSR=0.01 and CFI=0.99).

Table 6 presents the result for the measurement model corresponding to organizational performances.

As table 6 show, factor loadings are reasonably high. Yet all the coefficients are statistically significant and the model fit is adequate.

**Table 6. Standardized path results for organizational performances**

Path		Estimate	Standard Error	t Value	Model fit	
performances	- - - >	Average profits over the last three years	0.87	0.05	16.98	Cronbach Alpha=0.84 GFI =0.98 RMSEA=0



Path		Estimate	Standard Error	t Value	Model fit	
performances	- - - >	Average costs over the last three years	0.79	0.06	12.70	SRMSR=0.02 CFI=0.98
performances	- - - >	Average ROI over the last three years	0.58	0.09	6.27	
performances	- - - >	Increase in sales over the last three years	0.77	0.06	12.07	

#### 2.4. Analysis of structural model

Results for structural analysis are presented in table 7.

**Table 7. Results for structural analysis**

Path		Estimate	Standard Error	t Value
risks	---> strategy	-0.23	0.15	-1.60
performances	<--- risks	-0.01	0.14	-0.06
performances	<--- strategy	0.30	0.15	2.01
performances	<--- industry	0.06	0.13	0.43
performances	<--- Firm	0.28	0.12	2.28

After eliminating the indicator variables with inadequate factor loadings, we estimate the system of equation corresponding to figure 1. Table 7 documents a positive impact of SCRM strategy on organizational performances ( $\beta=0.30$ ,  $t=2.01$ ). This supports our second hypothesis of research.

Risks have a negative direct effect on organizational performances. However the estimated coefficient is not statistically significant in this case. Thus our results do not support the first research hypothesis. Once we control for strategy, the direct effect of risks on organizational performances is not significant.

The estimated coefficient corresponding to industry is not statistically significant. However firm size does have a positive impact on organizational performances. Consequently evidence for our third hypothesis is mixed.

Risks in supply chains are associated with SCRM strategy. However this relationship is only marginal significant and has to be confirmed by future research in the field.

#### 2.5. Implications

Based on existing literature in the field, we propose measurement scales corresponding to supply chain risks, SCRM strategy and organizational performances. We have found evidence of a low incidence of natural disasters in Romanian supply chains. Also organizational structure and human resources aspects do not display large association with

the latent variable measuring the risks in Romanian supply chains. We consider that achieving the full performance of Romanian supply chains requires a change in management' approach to work culture and motivation in national supply chains.

Analysis of the measurement model corresponding to SCRM strategy documents that contingency plans, support for suppliers and safety socks display high association with SCRM strategy. However there is evidence that in Romanian supply chains there is little concern for avoiding risky zone and developing a formal SCRM strategy. We think that management has to find solutions to solve these issues. With the increasingly volatile external markets, avoiding turbulent zones and developing a formal SCRM strategy is important in order to maximize performances.

## CONCLUSIONS

Present study documents the importance of developing adequate SCRM strategy for organizational performances. Results suggest that at national level it is necessary to develop a formal SCRM strategy and to avoid risky zones. We also have shown that management has to implement the changes in order to deliver value for relevant stakeholders, expanding and building up capabilities and scaling up improvements.

Finally, as a limitation we underline that the measures used in current research were based on perceptions of managers and the working dataset was relatively small. We mention that in some cases similar research use smaller samples (Antoncic and Scarlat, 2005). The practice of using perceptions of managers in analysis is common in ESC literature (Wang and Yen, 2012).

Notwithstanding its limitation, this study offers valuable managerial insight into the measures required for achieving the benefits of ESC and opens the way for future research in the field such as extending the number of controls employed in the analysis.

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